ML-M84A-USE Rev G

Gould
Micro 84 Programmable Controller

USER'S MANUAL

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SUBJECT: Description of the MICRO 84 Programmable Controller and the information necessary to configure, install, and program a control system.

SPECIAL INSTRUCTIONS: This manual supercedes the version dated May, 1984.

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PREFACE

This manual contains instructions for installing and programming the Micro 84 Programmable Controller. Section 2 describes the system components: controller, input/output modules, and programming devices. Installation is outlined in Section 3. System checkout is described in Section 4. Section 5 details the theory of operations. The P370 Programmer is described in Section 6 and programming procedures are given in Section 7. The P371 Program Pack, a device for transferring user programs is described, in Section 8. Four appendices, A through D, list error codes, supply programming examples, define terms, and give information on I/O modules.

RELATED PUBLICATIONS

ML-M84A-REF	Reference Card
PI-M84A-001	Programming Guide /P190
PI-J375-002	J375 Modbus Interface
PI-J378-002	J378 Modem

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INTRODUCTION

In an industrial environment, relays and solid-state electronic devices are used to provide the necessary control signals for control system applications. A relay can be either an electro-mechanical device or a solid-state electronic device that is "hardwired" to perform a particular function. When the application in which an electro-mechanical device is used is changed, the device must be modified (from normally closed to normally open, for example). In the case of a "hardwired" device, it must be replaced with one that is tailored to the application.

A programmable controller (PC) is a solid-state device that directly replaces the relays and "hardwired" electronic circuitry. A programmable controller can be quickly modified to adapt to a new or changed application. Gould introduced programmable controllers in the late 1960's. The first user was the automobile industry. Programmable controllers allowed them to avoid the time and expense of rewiring relay control systems at model changeover. Since then, the use of programmable controllers has expanded to cover a wide variety of industrial control system applications. Typical control system applications include machines used in cutting, grinding, and welding metals; equipment for assembling, packaging, and testing components and finished products; machinery for weighing, transferring, and otherwise handling materials; and systems for processing chemicals and foods.

The MICRO 84 is a microprocessor-based programmable controller designed to replace relay control systems that require 6 to 60 relays. In addition, the MICRO 84 provides the following benefits:

- Less expensive than an equivalent relay network
- Easily programmed using simple relay ladder diagrams
- Small—fits in an 8" deep NEMA 12 enclosure
- Simple to install
- Easy to use and maintain
- Designed for use in an industrial environment
- User program remains intact even if power fails
- Non-volatile memory (no battery required)

SECTION 2
SYSTEM CONFIGURATION

A typical programmable controller is divided into three components as shown in Figure 2-1. These components are the controller, the input/output modules, and a programming device. The programming device is the interface between the user and the programmable controller. The user program, located in the controller's memory, is entered using the programming device.

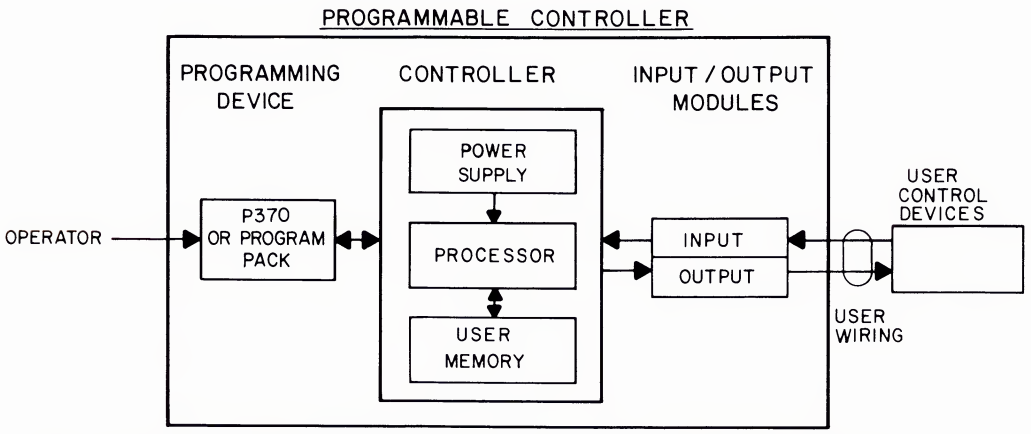

Figure 2-1. Programmable Controller, System Basic Block Diagram

2.1 CONTROLLER

The controller of the MICRO 84 system contains the processor, user memory, and the power supply.

2.1.1 Processor

The processor, the "brain" of the system, is a microprocessor-based system designed to replace relays, counters, timers, and sequencers. The main purpose of the processor is to use the user program and continuously monitor the status of all input signals from the control devices and to change the output signal to a device, if required. The processor can also perform arithmetic computations (addition and subtraction).

2.1.2 User Memory

A portion of the processor is designated for use by the user's logic program. It is in this area that the relay ladder diagram logic is stored. Once the ladder diagram program is entered into memory, it remains there until deliberately changed by the user. The program is not altered by power failure or power off conditions. The P370 Programming Panel is attached, through a cable, to a connector on the controller housing. This allows entry of instructions and data and also permits previously entered information to be monitored and changed.

2.1.3 Power Supply

The power supply operates on 115 VAC, or 220 VAC, 50/60 Hz. The appropriate voltage is jumper selectable (see Section 3). No adjustment or maintenance of the power supply is required. A lamp indicates power-ready status. No external cooling is required; however, free air circulation must be provided. The power supply has sufficient capacity to operate the P370 Programming Panel, the input/output modules, and the processor.

2.2 INPUT/OUTPUT (I/O) MODULES

A MICRO 84 Programmable Controller can communicate with up to 112 input and output points. I/O modules are either input or output and are discrete, register or analog. Each module can be connected to eight I/O points. The controller can handle a maximum of fourteen I/O modules. (See the configuration rules listed below for basic and expanded systems.) The input modules contain the circuitry required to convert incoming voltages to signal levels compatible with the processor. The output modules contain the circuitry required to convert processor signal levels to levels compatible with the devices being controlled. All input and output module circuits are optically isolated from the internal controller circuitry and therefore can withstand severe voltage transients without damage to the controller.

2.2.1 Module Characteristics

The simplicity of interlocking the I/O modules together represents a major savings in time for both the assembly and programming of the system when compared to competitive systems. A wide variety of I/O modules are offered. Each is designed to be an output driving or an input handling circuit.

The controller and I/O units are designed to operate in an industrial environment; they operate in locations where electromagnetic noise, high temperature, humidity, corrosive elements, and mechanical shock are prevalent.

2.2.2 Module Addressing

The terminal connections on the front of the I/O modules are associated with both an address in the processor (the reference number) and a specific piece of user equipment. To communicate, the processor selects the module address needed during operation. The proper addressing order is accomplished internally by the processor according to the module type and its physical location. The closer to the processor, the lower the module circuit address. This allows the installation of additional modules without repositioning the existing modules.

2.2.3 I/O Configuration Rules

Before configuring the I/O module portion of your Micro 84 PC system, refer to the serial number of the PC. If the PC serial number ends with "A", it is an expanded system. Follow the configuration rules in Section 2.2.3.2. If the PC serial number does not have an "A" suffix, it is a basic system. For basic systems, follow the configuration rules in Section 2.2.3.1. Contact your distributor or local sales office for information on upgrades.

2.2.3.1 I/O Configuration Rules - Basic System

A Micro 84 Basic System has either eight mixed I/O modules or fourteen discrete I/O modules. The eight mixed modules can be discrete, register, and analog modules, according to the following limitations.

a) A maximum of four B370 BCD Register Output **or** B374 4-20mA Analog Output Modules may be installed on one system.

b) A maximum of one B371 BCD Register Input, one B373 0-10VDC Analog Input, **or** one B375 4-20mA Analog Input Module may be installed on a system.

c) A maximum of eight discrete input or eight discrete output modules may be installed in one system.

2.2.3.2 I/O Configuration Rules - Expanded System

A Micro 84 Expanded System supports up to fourteen 300 Series I/O Modules, subject to the following configuration rules.

a) The maximum number of inputs and outputs combined cannot exceed 112.

b) A maximum of 8 discrete modules, any mix of input and output, may be installed in one system.

c) A maximum of 2 analog or register input modules may be installed on one system.

d) A maximum of 4 analog or register output modules may be installed on one system.

e) Analog or register modules must be physically mounted to the right of all discrete modules (see Figure 2.2).

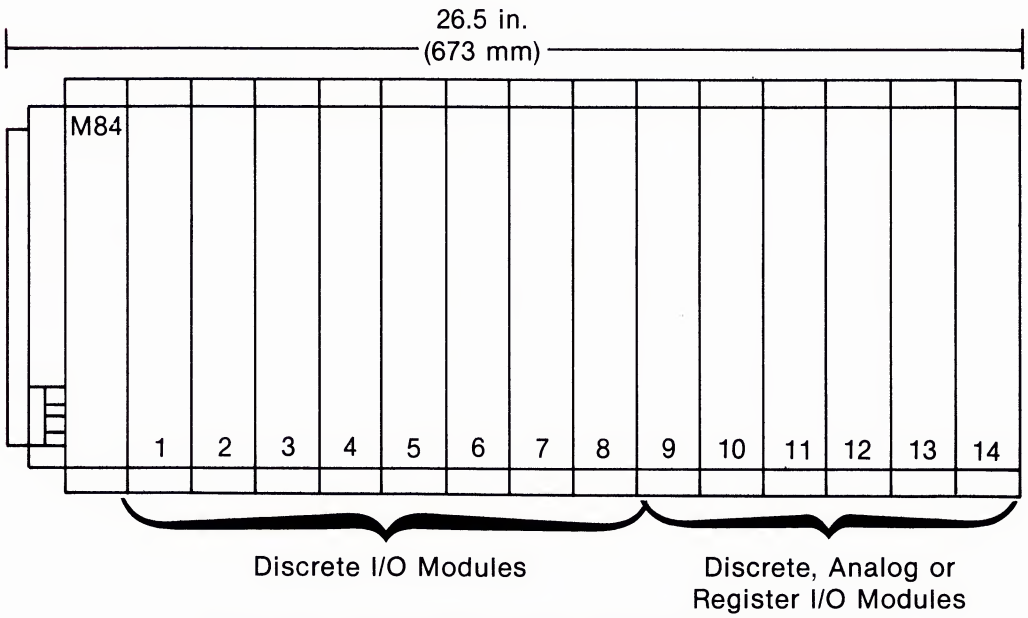

Figure 2-2. Expanded System Configuration Diagram

Surge withstand specifications for a configuration with more than 8 modules of any type is 1000 VRMS. If a system has 8 or less modules which are mixed discrete and register, the surge withstand rating is 1500 VRMS. Systems having a configuration with 8 or less discrete modules have a surge withstand rating of 2500 VRMS (IEEE 472-1974, ANSI C37.90a).

NOTE

When recording and then reloading a program into the same controller, remove the P371 Program Pack and then reinsert it before loading the program. This procedure prevents the occurence of false error conditions.

2.3 PROGRAMMING DEVICES

The principal peripheral devices which allow the user to interface with the MICRO 84 Programmable Controller are the P370 Programming Panel and the P371 MICRO 84 Program Pack.

2.3.1 P370 Programming Panel

The P370 Programming Panel incorporates a function keypad and a liquid crystal display (LCD) in a rugged, compact case. This facilitates hand-held operation at the controller site. The programming panel connects to the MICRO 84 Controller and provides a simple method of programming the user memory from a ladder diagram. The "language" used to program the controller utilizes familiar relay symbols; there is no requirement to learn a programming language. In addition, the LCD readout allows rapid and easy system checkout and maintenance. See Section 6.

2.3.2 P371 Program Pack

The program pack incorporates a memory identical to the user's portion of the controller memory. Once a program is loaded into user memory, a copy of that program can be loaded into the program pack for storage. The program in user memory is left intact. Once the program pack is loaded with a program, that program can be reloaded into the same MICRO 84 or another one that is to perform the same functions. Loading a program into the program pack is controlled using the P370 Programming Panel. Loading a program into a MICRO 84 is controlled from the programming pack. See Section 8.

NOTE

When recording and then reloading a program into the same controller, remove the P371 Program Pack and then reinsert it before loading the program. This procedure prevents the occurence of false error conditions.

SECTION 3
SYSTEM INSTALLATION

The MICRO 84 Programmable Controller mainframe is easily installed in a standard 8" deep NEMA rack. Figure 3-1 illustrates a typical system layout, providing mounting dimensions of all major components. Figure 3-2 provides mounting hole dimensions. For proper heat flow, all units should be mounted vertically. This allows natural air flow and removal of heat by way of the heavy duty housing fins. For Class I operating environments where air tight explosion-proof enclosures are employed, a minimum of six inches is necessary for heat dissipation between the top, bottom, sides, and front of the MICRO 84 and the enclosure.

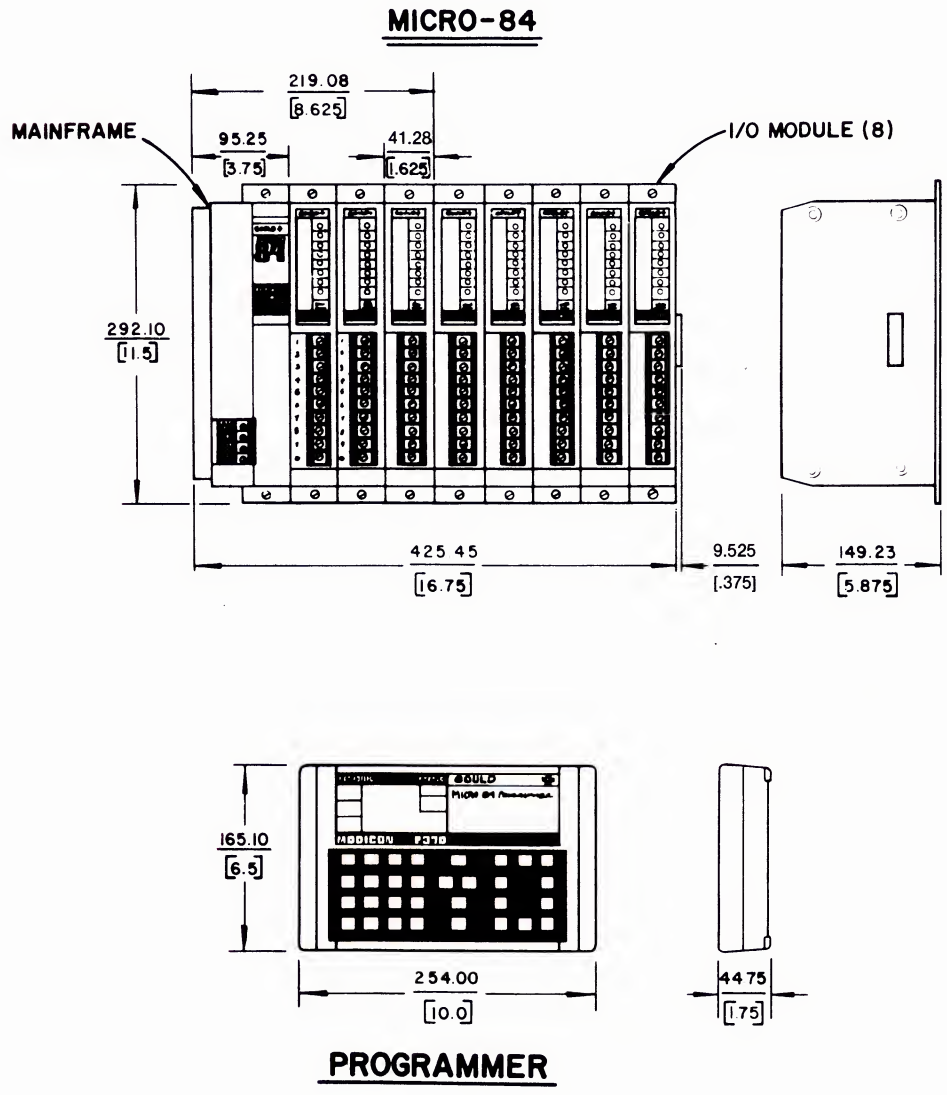

Figure 3-1. Typical System Installation

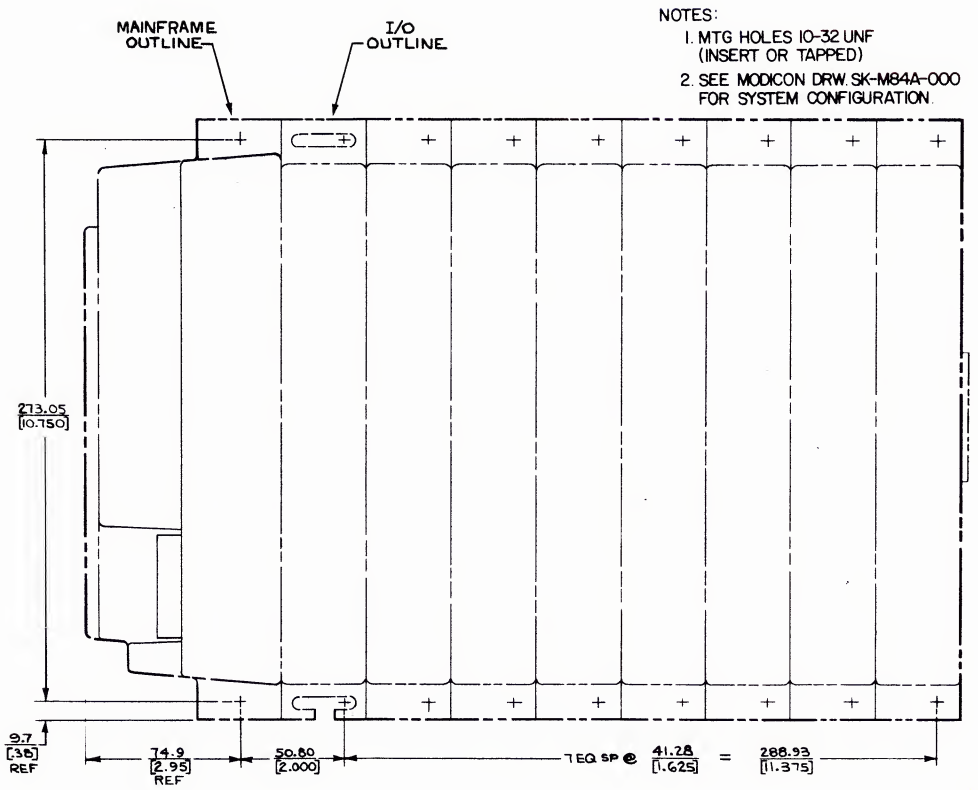

Figure 3-2. MICRO 84 Mounting Dimensions

3.1 SYSTEM REQUIREMENTS

Each MICRO 84 Programmable Controller requires an M84A mainframe unit (controller) containing the processor, user memory, and power supply, a combination of up to fourteen input and output modules for user equipment connections, and a P370 Programmer to allow communication between the user and the system. The MICRO 84 is available with one of two memory sizes. The memory size determines the number of networks that can be programmed into the controller (see Table 3-1).

Table 3-1. System Memory Sizes

MODEL	I/O MODULES*	NETWORKS
M84A-001 (1K)	8 (basic system)	9
M84A-002 (2K)	14 (expanded system)	18
*Each module can be connected by a maximum of 8 input or output points.		

3.2 SYSTEM SPECIFICATIONS

Table 3-2 contains the specification for the various components of the MICRO 84 Programmable Controller system:

Dimensions (WxHxD):	
Mainframe (w/Power Supply)	3.75 in. X 11.50 in. X 5.875 in. (95.25mm X 299.10mm X 149.23mm)
Single I/O Module	1.625 in. X 11.50 in. X 5.875 in. (53.95mm X 292.10mm X 149.23mm)
P370 Programming Panel	10.00 in. X 6.50 in. X 1.75 in. (254.00mm X 165.10mm X 44.75mm)
Program Pack	2.88 in. X 1.50 in. X 5.00 in. (73.15mm X 38.10mm X 127.00mm)
Weight:	
Mainframe (w/Power Supply)	5 lbs., 6 oz. (2.44 kg)
Single I/O Module, output	1 lb., 13 oz. (0.82 kg)
Single I/O Module, input	1 lb. (0.45 kg)
Programming Panel	1 lb., 10 oz. (0.74 kg)
Program Pack	8 oz. (0.23 kg)
Power Requirement:	115 or 220 VAC, ± 15% 47 to 63 Hz, 50 watts max. NOTE: The 220 VAC option requires the removal of a jumper on the external power terminals.
Environmental Requirements:	
Ambient (Room) Temperature, mainframe	0° to 60°C
Ambient (Room) Temperature, programming panel	0° to 40°C
Relative Humidity	0% to 95% (non-condensing)
Shock	10 G for 11 msec.
Vibration	.625 G, 50 to 500 Hz
EMI (electromagnetic Interference)	MIL-STD 461 B
MI (magnetic interference)	HELMHOLTZ Coil
RFI (radio frequency interference)	FCC Class A
SWC (surge withstand capability)	IEEE 472-1974 & ANSI C37.90A

Table 3-2. MICRO 84 Specifications

3.3 CONTROLLER

The MICRO 84 controller (Model M84A) is contained within a rugged metal housing that is designed to screw mount into a standard 8" deep NEMA rack. The controller can also be screw mounted onto a wood mounting panel.

Located on the housing front is a five screw terminal strip and two indicating lights. The terminal strip is used to connect external AC power to the MICRO 84 system. The upper indicating light, (POWER), is illuminated when external AC power is applied to the power supply. The lower indicating light, (RUN), is on when the processor is solving the logic networks. Refer to Figure 3-3.

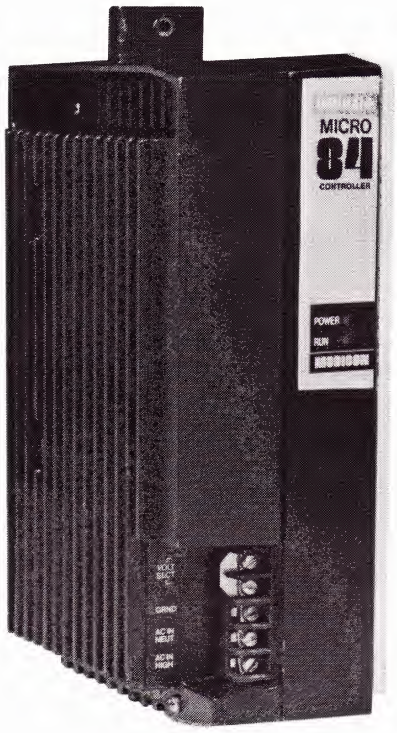

Figure 3-3. MICRO 84 Controller

Located on the bottom of the controller are two female sockets that are used in connecting peripheral (user interface) devices to the controller. The socket closest to the front of the controller is for the P370 Programmer and the other is for the P371 Program Pack (see Figure 3-4).

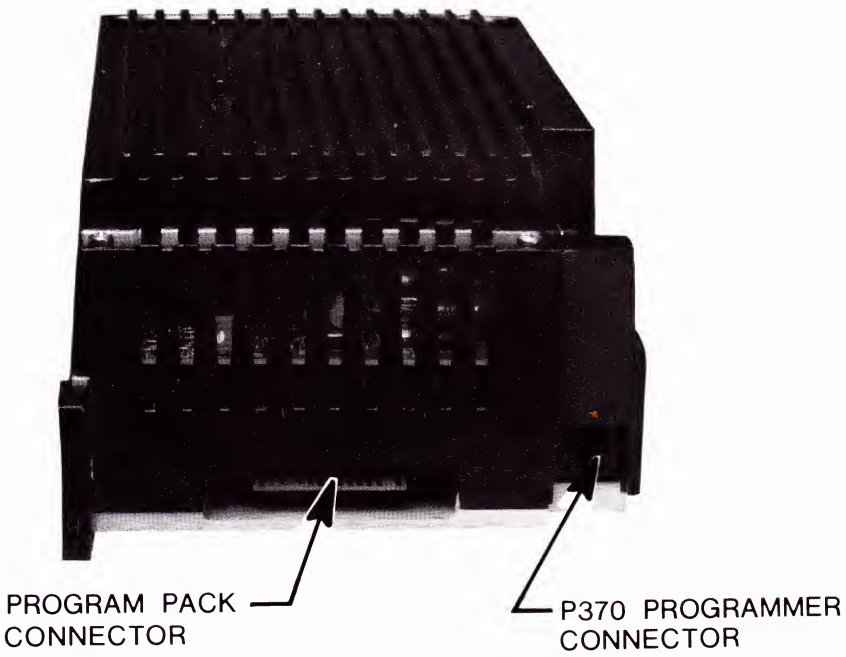

Figure 3-4. Bottom of MICRO 84 Controller

A female socket is located on the right side of the controller housing. This socket is the link between the controller unit and the input/output and register modules. A terminator plug, supplied with the controller, must be inserted into the rightmost I/O module during system operation. Programs can be generated in the MICRO-84 without any I/O modules as long as the terminator plug is inserted into this socket.

3.4 INPUT/OUTPUT MODULES

The B300 Series modules are contained in rugged plastic housings that can be screw mounted into a standard 8" deep NEMA rack. Located on the housing front are circuit indicating lights that turn on to indicate when a particular circuit is active. Screw terminals connect the MICRO 84 to the user's equipment. An interconnecting socket is located on each side of the I/O housing. The left side socket allows communication between the I/O module and the controller and the right side socket allows communication between additional I/O modules and the controller. The last I/O module must have the terminator cap, shipped with the controller, inserted in the right side socket.

All user control devices that provide input to the MICRO 84 are connected to the screw terminals located on the input modules. All user devices that are controlled by the MICRO 84 are connected to the screw terminals located on the output modules. Refer to Figure 3-5.

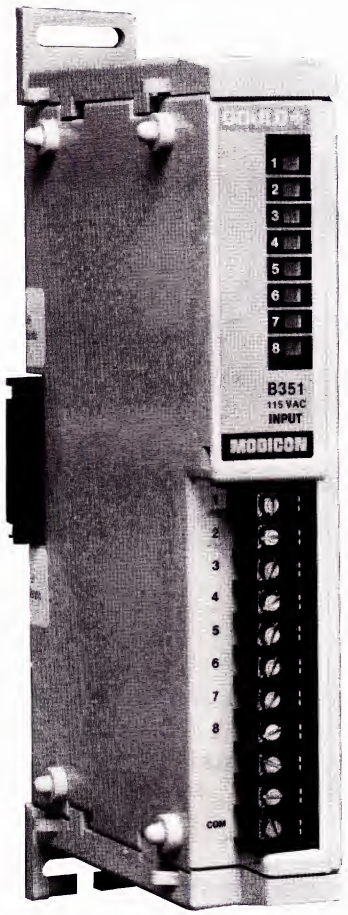

Figure 3-5. Typical Discrete I/O Module

3.5 COMPONENT MOUNTING

The MICRO 84 controller (M84A) unit is secured to the mounting surface using two screws, one top and one bottom. See Figure 3-1. After securing the controller unit, the first input/output module is plugged into the controller using the connector located on the right side of the controller unit. Use the tabs (mating protrusions) on the left side of the module to assure proper alignment of the module with the controller. Each module has upper and lower sliding interlocks. Both should be pulled out before installing and pushed in after the module is properly mated to the adjacent module. Once positioned and secured to the controller, the module can then be fastened to the mounting surface using two mounting screws. Position I/O mounting screws at the rightmost side of the slotted holes so that the modules can slide to the right for easy removal. Refer to Figure 3-6. Additional modules can then be added and fastened in the same way. Care should be exercised not to overtighten the screws used to mount the I/O modules.

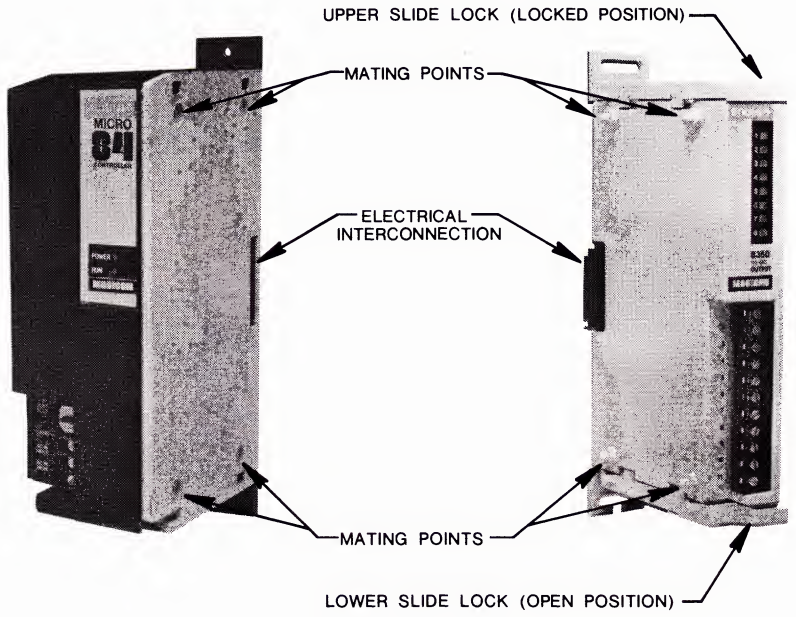

Figure 3-6. I/O Module Interconnections

3.6 SYSTEM WIRING

After properly mounting the MICRO 84 Controller and I/O modules, the external AC power and I/O wiring connections can be made. It is recommended that separate sources of power be used for the controller and I/O modules.

3.6.1 AC Power Connection

The MICRO 84 power supply can be used with either 115 or 220 VAC, 50/60 Hz power. The presence or absence of a jumper between the upper two terminals determines the voltage. Remove the jumper for 220 VAC operation. Refer to Figure 3-7 for the proper wiring connections.

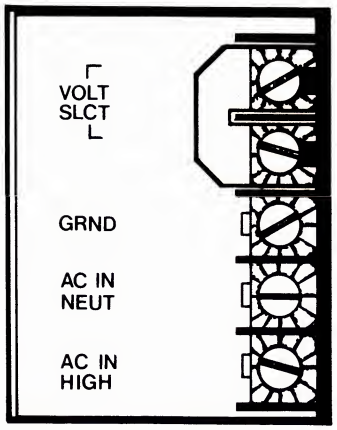

Figure 3-7. Connection of External Power to MICRO 84

3.6.2 I/O Wiring

The I/O module wiring information included in this paragraph is specifically for the B351, 115 VAC Input module and the B350, 115 VAC Output Module. Wiring information, and other technical information, for these modules and all other MICRO 84 I/O Modules are contained in Appendix D.

A discrete control device is assigned automatically to an internal memory address according to which screw terminal the device is connected. On both the input and the output modules, screw terminals 1 through 8 connect the MICRO 84 to specific user control devices. Input addresses range from 1001 through 1032 (1064 for the M84A-002) while output addresses range from 0001 through 0032 (0064 for the M84A-002). Refer to Figures 3-8 and 3-9 for the wiring scheme for input and output modules.

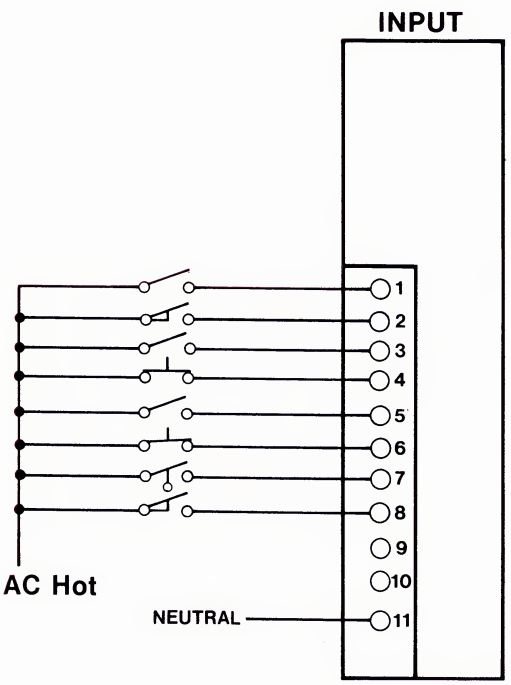

Figure 3-8. Input Module Wiring

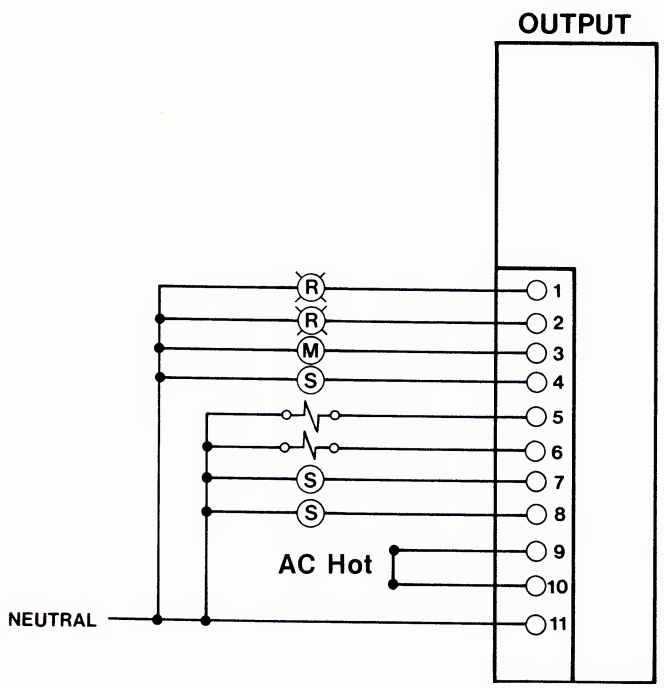

Figure 3-9. Output Module Wiring

3.6.3 I/O Module Addressing

The proper addressing of the I/O modules is accomplished automatically by the controller. The closer to the controller, the lower the I/O module's address. This allows for the installation of additional I/O modules without disturbing the existing I/O module/addressing sequence. Refer to Figure 3-10.

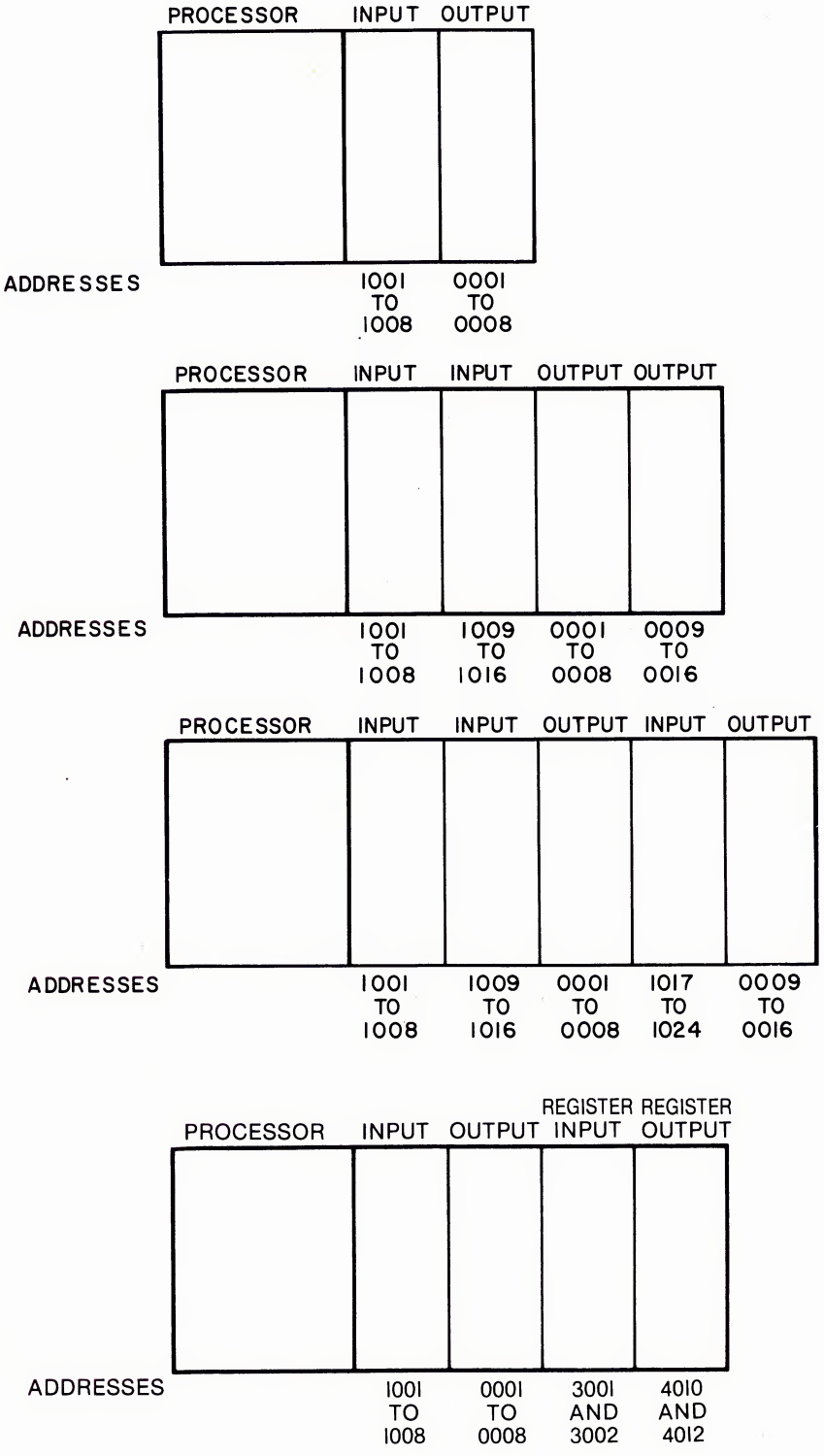

Figure 3-10. I/O Addressing

SECTION 4
SYSTEM CHECKOUT

4.1 CONTROLLER OPERATION

After securing the MICRO 84 controller using the two mounting screws and ensuring proper external AC power connections are made, AC power can be applied to the controller. When AC power is applied, the controller POWER light illuminates indicating the power supply is fully operational. The RUN light does not illuminate unless the controller has been started and the terminator plug is in the right-hand connector. The controller is started initially using Supervisory Code 2 which is entered from the P370 Programming Panel.

The controller is started also when using the program pack to load a program into the controller. If power is applied (power light on) and the controller is not running, the second push of the program pack pushbutton starts the controller. (See Section 8.) Also, if the controller was running when power was removed, it will be running when power is once again reapplied.

Once started, the processor's memory is fully operational.

CAUTION

During the power up sequence, AC output modules may cause the false triggering of certain loads for one-half cycle. The loads that are most susceptable are:

Latching relays
Fast-acting solenoids
(Hydraulic/pneumatic valves)
Latching circuits
(Motor starter with seal contact)

Special circuit designs have been incorporated into the AC output modules to minimize this false triggering. However, applications using fast reacting or latching devices that initiate mechanical action may be a hazard due to false triggering.

4.1.1 Power-Up Sequence

During the power up sequence, the processor logic executes a program of diagnostic tests to ensure that all system hardware is functioning properly.

If an error is detected during the power-up sequence, the system halts. If the P370 Programmer is connected, an error code is displayed on the panel. If the programmer is not connected, no external indication of the error is available but the error code is stored in a location in the controller memory. When the P370 Programmer is reconnected to the controller, the error code that has been stored will be displayed on the panel.

If all tests pass, the following sequence occurs:

1. All coils are set OFF with the exception of latched coils and coils which were disabled when power was last removed. These coils retain their latched or disabled state.

2. All inputs are read including input registers.

3. If the controller has been started, the RUN light on the controller is illuminated and the unit starts solving logic at network 1.

When AC power is applied to the mainframe, the power supply begins producing DC power. There is a slight delay between the time the DC voltages are within regulation and the processor begins operating. This delay allows sufficient power to be stored to ensure that proper power-down procedures can be performed by the processor when AC power is removed.

Upon an indication of power failure, appropriate information is stored to permit an orderly start-up, the RUN light is extinguished, and all outputs turned OFF.

4.1.2 Power-Down Sequence

When AC power is removed, the controller continues to operate using the power stored during the power-up sequence. If AC power is not restored within 1/10th of a second, the controller executes an orderly power-down sequence. The controller can operate for a longer time depending upon the devices (Programmer, I/O modules, etc.) that are connected to the mainframe at the time of power-down. Prior to actual loss of DC power, a warning signal is provided from the power supply to the processor. This warning signal causes the processor to stop solving logic wherever it is in the scanning process, and to begin the power-down sequence.

The power-down sequence is performed to completion even if AC power is restored. The power-down sequence requires less than 1/10th of a second.

During the power-down sequence, the controller calculates and stores a value for the contents of the random access memory. This value is used during power up to verify the content of memory. In addition, all outputs are turned OFF. The status of coils and the contents of registers are retained for use during the power-up.

If it is necessary to remove power from the unit, remove power from the controller first. Removing power from the I/O first, or at the same time as the controller, can cause incorrect data to be stored during the power-down sequence (if the controller was running at the time power was removed).

4.2 P370 PROGRAMMER OPERATION

Plugging the P370 Programmer into the mainframe supplies power to the programming panel and enables the processor to initiate a diagnostic test of the Programmer circuits. The COMM-OK status display should illuminate. During this sequence, scan time is increased significantly.

All liquid crystal display segments turn on allowing the user to visually verify that all the segments are operating (turned on). Refer to Figure 4-1 for an illustration of the P370 displays.

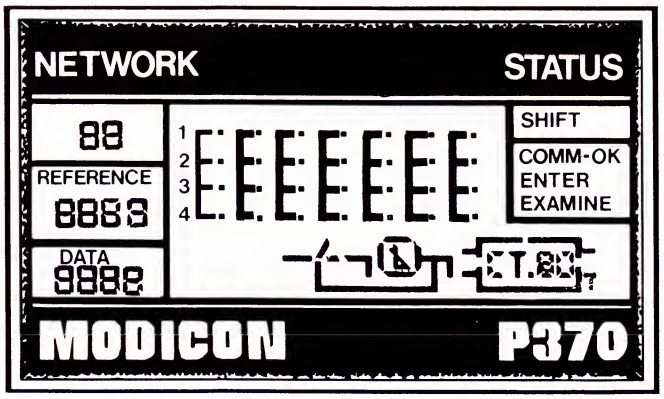

Figure 4-1. P370 Programmer With All Display Segments Lit

The display segments remain on for approximately 2.5 seconds and then turn off. After another 2.5 seconds, network 1 is displayed with the cursor at row 1, column 1. If the internal diagnostic tests detect an error between the controller and the programming panel, the error code will be displayed in the DATA area. Refer to Appendix A for an explanation of the error code. When not actively using the P370, it should be removed from the controller and stored in an appropriate environment.

4.3 SYSTEM CHECKOUT AND MAINTENANCE

The Disable function (see Section 6) can be used during the checkout and maintenance of the control system.

In checking out a system, the disable function can be used to verify the proper wiring and operation of all discrete output coils. Each output is displayed on the P370 Programmer and then disabled. The coil can be cycled ON-OFF-ON-OFF, etc., and proper operation of the discrete device observed. It is recommended that the coil be enabled before the next output is tested to prevent unwanted functions from occurring in the control system.

During control system maintenance, a particular "real-world" device can be removed from MICRO 84 control by disabling either all the inputs (discrete and register) or the logic coil associated with the device. The device can then be repaired or replaced without affecting MICRO 84 operation. When maintenance is complete, the device can be cycled by toggling it on and off from the P370 Programmer. After a successful checkout, the device can be put back on line by enabling the disabled logic element.

The disabled state of a coil or discrete input is retained after the P370 Programming Panel is removed. This provides the ability to use this capability without leaving the programmer connected permanently.

SECTION 5
THEORY OF OPERATION

The MICRO 84 system controls user equipment by means of a program stored in the user memory and by communication with the I/O section as illustrated in Figure 5-1.

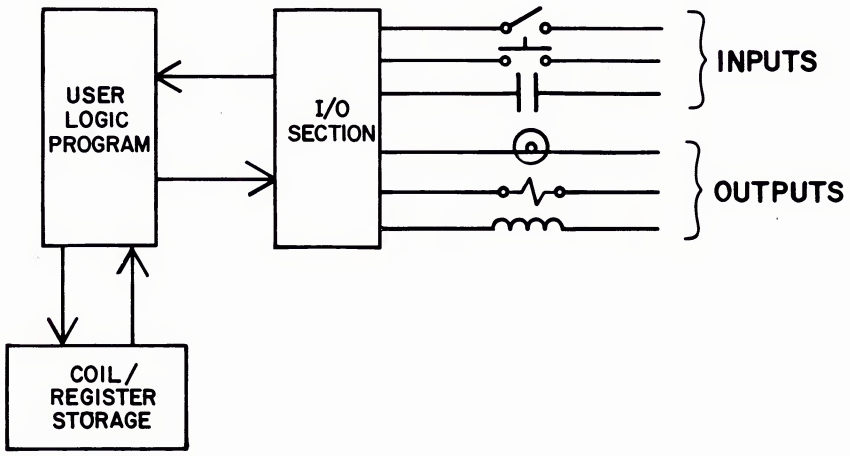

Figure 5-1. System Block Diagram

5.1 SCAN

The MICRO 84 Programmable Controller solves each network (see Section 7) in their numeric sequence. A network is a group of logic elements that are connected together to perform a specific function (for example, a motor starter control circuit). Network 1 is the first network to be solved, followed by network 2, 3, etc., until all networks are solved. The controller then returns to solve network 1 again. The time it takes from the completion of solving any network on one scan until that network is again solved on the next scan is the "scan time" of the controller. Scanning occurs at a very rapid rate.

Within each network, logic elements are solved from the left rail towards the right rail and on a column by column basis.

The numeric contents of a register, once updated, can be used by all subsequent logic elements in a network (in the same or next column). All inputs and outputs are updated only at the end of each scan.

Scan time varies depending upon the amount and type of logic entered.

5.2 INPUT/OUTPUT (I/O) MODULES

The MICRO 84 input/output modules isolate the internal processor from the external user-supplied devices. This isolation prevents electrical noise from affecting processor operation. The processor responds to the condition of an external device (on, off, or numeric value). There are two major groupings of I/O modules:

- Discrete I/O
- Register I/O

5.2.1 Discrete I/O Modules

Each discrete I/O module can be connected to a maximum of 8 discrete devices. A discrete device is one that can be either ON or OFF.

Type of Device	Reference Numbers	Processor
Input (Pushbutton switches, Limit switches, etc.)	1001-1032 1001-1064	(M84A-001) (M84A-002)
Output (Lights, motor starters, etc.)	0001-0032 0001-0064	(M84A-001) (M84A-002)

5.2.2 Register Modules

Register modules provide the capability of handling numeric values (000-999) within the Micro 84 Programmable Controller. These values are represented either in binary coded decimal (BCD) or as an analog voltage or current. These numeric values can be either received from an external device or sent to an external device.

The following list describes the type of register module and its associated reference numbers:

Type of Device	Reference Numbers	Processor
Input, (Thumbwheel, Panel meter, Temperature, Pressure, and Flow transducers, etc.)	3001-3004	Both
Output, (Digital display, Valves, positioning devices, etc.)	4010, 4012, 4014, 4016	M84A-001
	4010, 4012, 4014, 4016, 4018, 4020, 4022, 4024	M84A-002

SECTION 6
P370 PROGRAMMER

The P370 Programmer (Figure 6-1) is the primary interface for the programming and monitoring of the MICRO 84 Programmable Controller. The programmer is a rugged, portable, hand-held unit that contains a function keyboard and a liquid crystal display (LCD). The LCD consists of a 4 (row) X 7 (column) node display and shows the power flow in a network in relay ladder diagram form. When a logic element is programmed into a specific row and column, that location is indicated by a node, or point of light, on the network display. The actual element is not shown. Specific information about an individual logic element (the logic element under the cursor) is displayed in the REFERENCE, DATA, STATUS, and Element Display areas of the LCD.

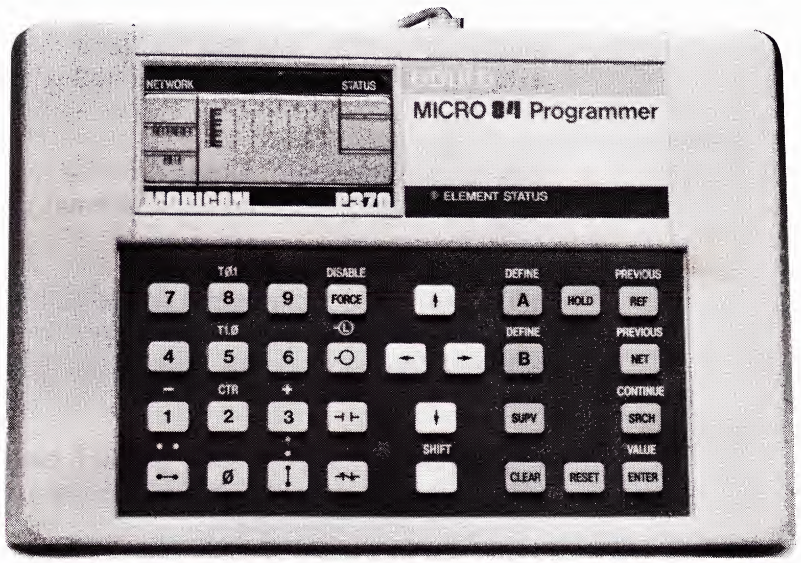

Figure 6-1. P370 Programmer

The programmer is connected to the MICRO 84 Programmable Controller, through a cable assembly. It provides a simple method of programming the user's portion of the memory from a ladder diagram. The "language" used to program the controller utilizes familiar relay symbols; there is no requirement to learn a programming language. In addition, the LCD readout allows rapid and easy system checkout and maintenance.

The front of the programmer's panel is divided into an upper section and a lower section. The upper section consists of the liquid crystal display area and an Element Status light; the lower section consists of the function keyboard and keylock switch.

6.1 PROGRAMMER OPERATING MODES

The P370 Programmer operational functions may be broken down into four distinct modes:

- EXAMINE Mode (including Hold State)
- DATA ENTRY Mode
- SUPERVISORY Mode
- ERROR Mode

Each mode has specific effects on the display and keyboard operations.

6.1.1 Examine Mode

- Normal monitoring of network power flow and status of any node within the network.
- Monitoring the value or status of any register or coil (using the REF key) that is not associated with the node located at the cursor position.
- In the HOLD state, the contents of the Data display are frozen, allowing examination of the reference value.

The programming panel enters the EXAMINE mode automatically after the power up diagnostics have successfully completed. The cursor is positioned at row 1, column 1 of network 1.

6.1.2 Enter Mode

In the Enter mode, new information is entered into the programmer for subsequent entry into the controller. This can be new nodes, updating existing node information (reference, element type), register values, etc.

6.1.3 Supervisory Mode

The Supervisory mode allows the user to enter and initiate the supervisory commands for the controller's internal memory.

6.1.4 Error Mode

In the event of a programmer or controller error condition (diagnostic error, communication error, or user error in entering data), the programmer automatically enters the error mode and displays the appropriate error code.

Depending on the error code present, certain keys will be operational. The RESET key or the SHIFT/RESET keys are used to recover from an error condition (see Appendix A).

6.2 DISPLAY AREA

The upper section of the programming panel is the LCD and consists of three display areas:

- Reference Data
- Node and Element
- Status

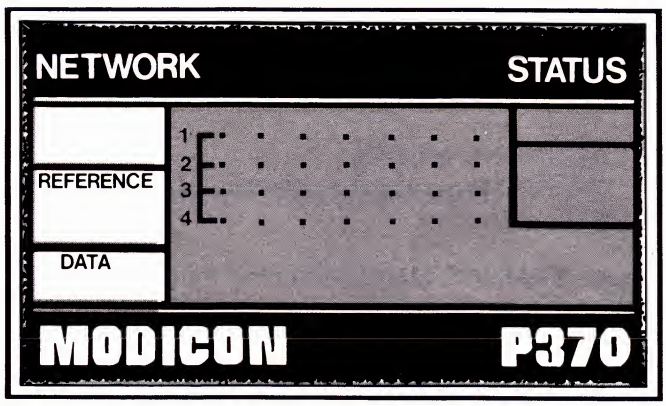

Figure 6-2. Reference Data Area

The intensity of the display can be controlled by the knurled, slotted plastic screw on the bottom of the panel. Rotating the screw clockwise increases the intensity of the display.

6.2.I Reference Data Area

The reference data area contains three separate displays; network, reference, and data. (See Figure 6-2.)

6.2.1.1 Network Display

The two digit network display indicates which of 9 (I8 in the M48A-002) networks is currently being viewed. The keyboard allows the user selection of any network. Each network can contain up to 28 logic elements.

6.2.1.2 Reference Display

The four digit reference display, when used in conjunction with the cursor's position, displays an element's assigned reference number if any. If the cursor is positioned on the upper node of a double node element, the preset is displayed. For the lower node, the reference number of the holding register is displayed.

6.2.1.3 Data Display

The four character data display contains the register contents, or element status, of the logic element at the current cursor position. The register contents is a numeric value in the range from 000 to 1023. The element status is either OFF or ON.

6.2.2 Node and Element Display

The node display (see Figure 6-3) is the area where power flow for each node within a network is displayed in ladder diagram form. Power flow through a node's associated element illuminates that node. A particular node can be selected by moving the cursor; the node on which the cursor is positioned blinks and the element is displayed in the element display area. (Figure 6-3 Node Display Area.)

The element display (see Figure 6-4) has two sections; the left section for single node elements (contacts, coils), the right section for the upper or lower half of double node elements (counters, timers, arithmetic operations). When the cursor is positioned on a node, only one section of the element display illuminates, indicating the type of element contained within that node. If the cursor is placed on the top node of a double node element, only the top node is displayed. (See Figure 6-4 Element Display Area.)

6.2.3 Status Indicators

Five status indicators are contained on the right section of the programming panel. Four of the indicators are a part of the LCD display while the fifth (ELEMENT STATUS) is on the face of the panel.

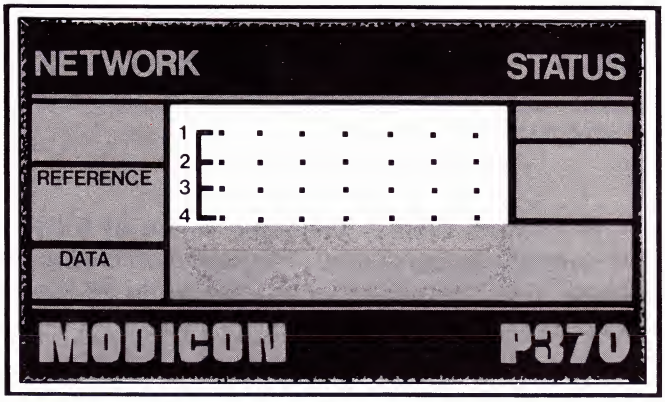

Figure 6-3. Network Display Area

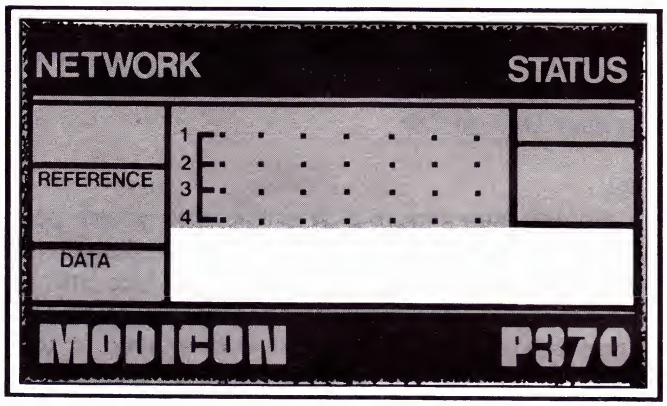

Figure 6-4. Element Display Area

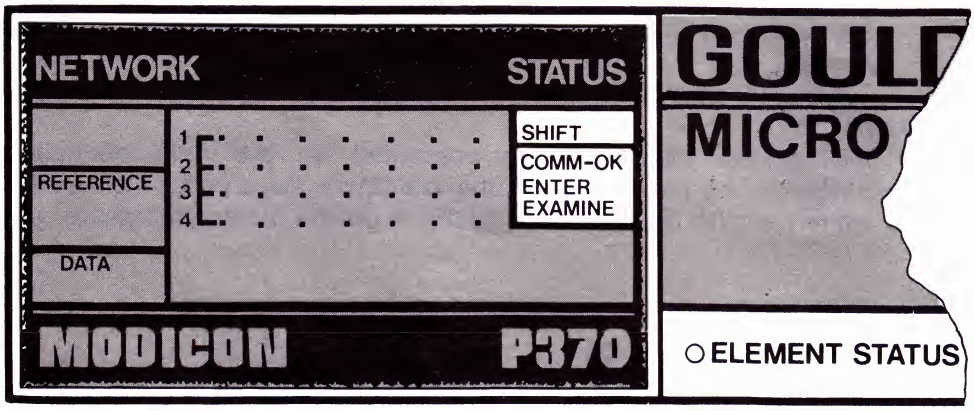

Figure 6-5. Status Indicators

SHIFT
Indicates that the next keystroke will have its shifted value. The legends printed on the panel indicated the shifted function while the legend on the key caps indicated the normal (unshifted) function.

COMM-OK
Indicates that the connection between the panel and controller is secure.

ENTER
Indicates that data is being changed. When the ENTER pushbutton is pressed, the data that is displayed on the programmer is entered into the controller. The ENTER indicator remains on until the data is transferred and entered into the processor. After the data is entered, the ENTER indicator is extinguished and EXAMINE is illuminated.

EXAMINE
Informs the user that the logic element under the cursor's position is being viewed in the reference data, node display, and element display areas.

ELEMENT STATUS
A light emitting diode (LED) is located on the front panel and is illuminated when power is flowing through the logic element under the cursor. This is necessary because it is impossible to determine power flow through the logic element at the cursor position because the cursor is constantly blinking. The blinking is necessary for cursor identification and it overrides any other indicator in a node.

6.3 KEYBOARD

The lower section of the P370 Programmer contains the function keyboard. The function keyboard contains the control keys necessary to enter numeric data and logic elements, move the cursor, and perform the various programmer functions (see Figure 6-6). When using the keyboard, press each key in the keystroke sequence firmly. Pressing a key lightly or quickly may result in that keystroke being ignored.

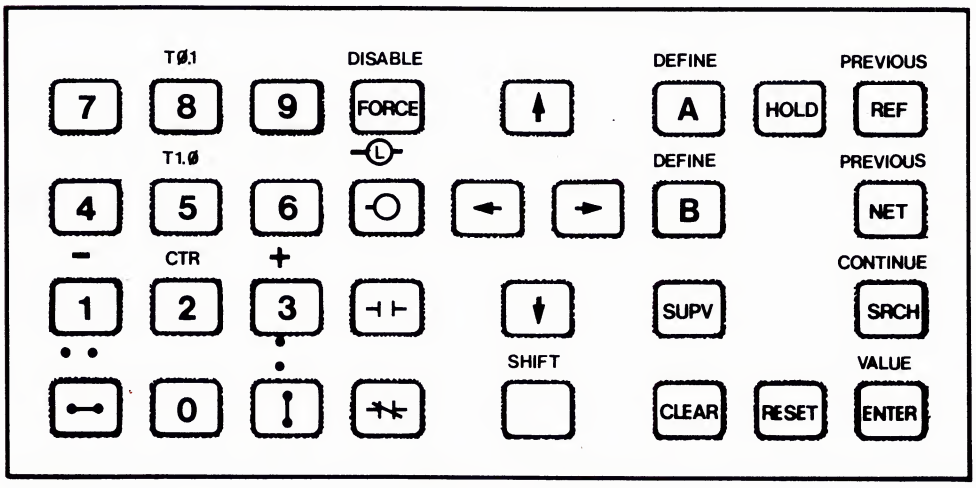

Figure 6-6. Function Keyboard

6.3.1 Numeric Keys

Numeric keys 0-9 are used for entering the required numeric data (reference numbers, preset values, register controls, etc.). See Figure 6-7.

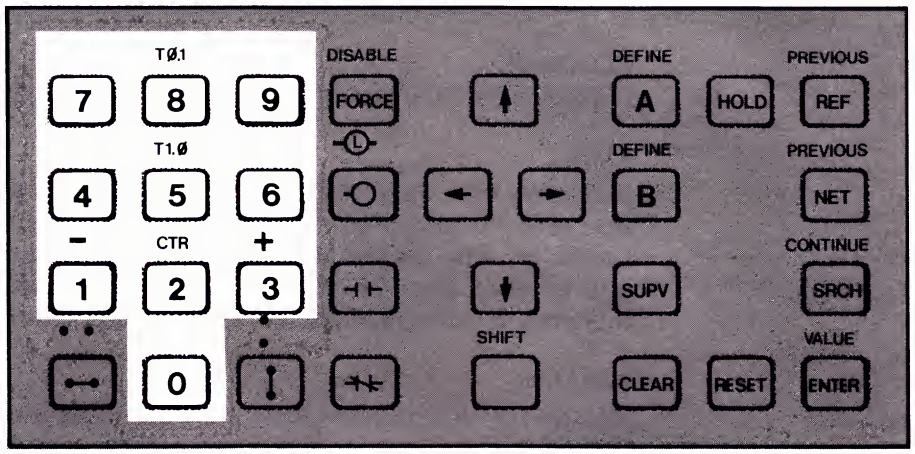

Figure 6-7. Numeric Keys

6.3.2 Logic Element Keys

The logic element keys (see Figure 6-8) are used to select the logic element to be placed at each node in a ladder logic network. Some of the logic elements are shifted values of a similar element or numeric key.

6.3.3 Cursor Control Keys

A set of four keys are provided to control cursor movements (see Figure 6-9). When pressed, each key moves the blinking cursor one node in the direction indicated by the arrow on the key cap.

Positioning the cursor beyond the first or seventh column on the network display causes the cursor to appear in column seven or column one of the same row (wraparound). The cursor also wraps around when being moved up and down.

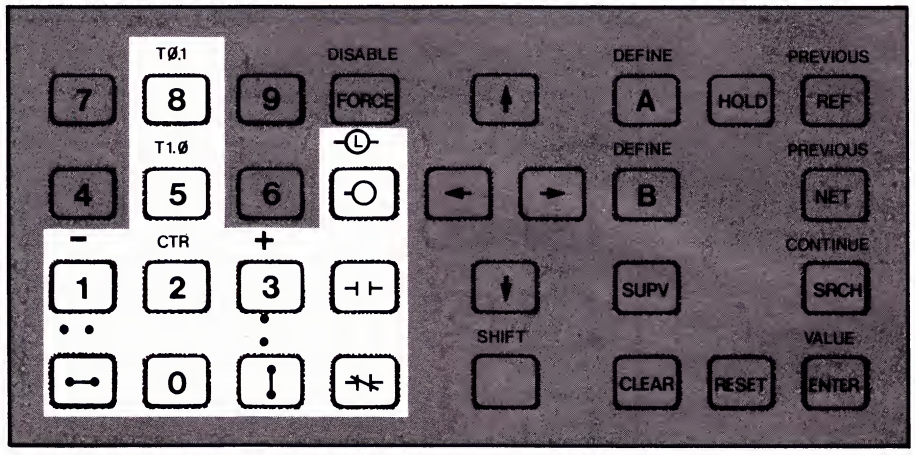

Figure 6-8. Logic Element Keys

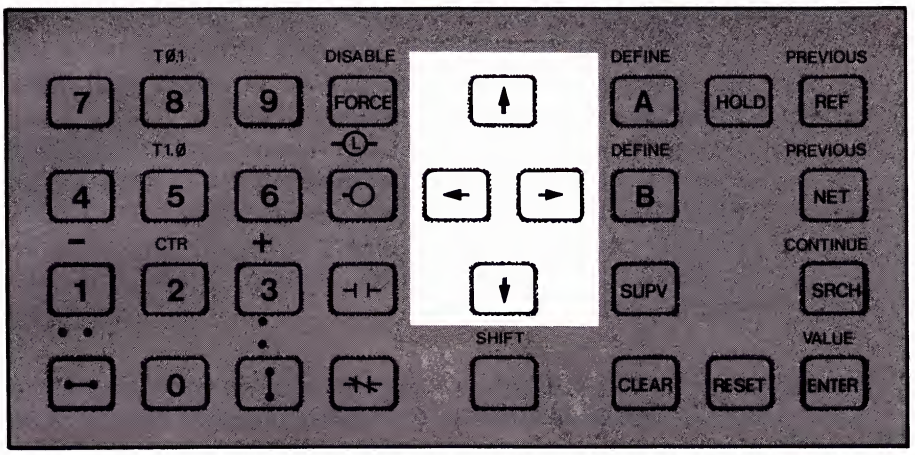

Figure 6-9. Cursor Movement Keys

6.3.4 Function Keys

The function keys provide direct user interaction with the controller (see Figure 6-10).

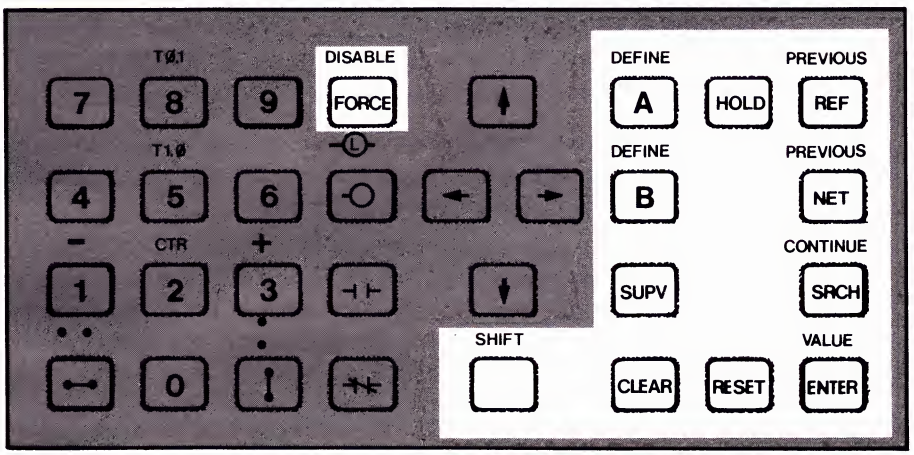

Figure 6-10. Function Keys

6.3.4.1 SHIFT

When the Shift function is on, the shifted operation of a double function key will be performed when the function key is pressed. The shift function is obtained by pressing the SHIFT key. The shifted operations are printed on the P370 Programming Panel surface above the key. When used with keys having only a single (lower) key function, the SHIFT function is ignored.

The SHIFT function is cancelled by pressing any key other than REF, NET, or SRCH.

6.3.4.2 A - SHIFT/DEFINE A
B - SHIFT/DEFINE B

The A and B keys are assigned by the controller to specific registers; the A key is assigned to register 4010 and the B key is assigned to register 4020. When either key is pressed, the register number assigned to that key appears in the reference display and the current contents of the register appear in the data display. This allows the user to recall a register (4010 or 4020) and view its contents using one keystroke. Normally, five keystrokes (4-digit register number and REF) are required to recall a register and its contents.

The register number assigned to the A and B keys can be changed to any of the available registers (40XX only) whose contents are viewed frequently. These new assignments will be in effect until changed (i.e., assignments are not affected by power down).

To change the assigned register number, enter the desired register number into the data display, then press SHIFT/A or SHIFT/B as appropriate. The SHIFT is required to choose the DEFINE A or DEFINE B function. The register number entered appears in the reference display and the register contents appear in the data display. During this interval the element display goes blank.

NOTE

The redefined A and B register assignments will not be maintained when the user's program logic is dumped to the P371 Program Deck. When the logic is reloaded, the 4010 and 4020 assignments will be in effect.

6.3.4.3. SUPV

The supervisory mode can only be used if the Memory Protect feature is OFF. It is entered by pressing the SUPV key. When in any mode other than the supervisory mode, pressing the SUPV key causes the following displays to blank: network, data, power flow and cursor, element type, enter, examine, and element status light. The REFERENCE display reads SUP0 for panel mode operation. COMM OK remains illuminated.

The supervisory commands allow the user to control processor operation. Table 6-1 contains the supervisory commands, associated code number, and the action taken by the controller.

To enter a supervisory command, press SUPV, the code number, and ENTER, in that sequence. When using SUPV 4, it is not necessary to press the ENTER key to initiate the action (i.e., SUPV and 4 is all that is necessary). Pressing ENTER a second time causes the controller to perform the indicated action.

Table 6-1. Supervisory Codes and Actions

COMMAND	CODE	ACTION
EXIT	0	Returns Programmer to EXAMINE mode.
STOP CONTROLLER	1	Halts the logic solving (SCAN) controller operation.
START CONTROLLER	2	Starts the logic solving (SCAN) controller operation. Coil status (ON or OFF) is retained as it was prior to stopping the controller. To clear coils, either reload program from Program Pack or power-down and power-up the mainframe, or turn off coils prior to stopping controller.
CLEAR MEMORY	3	Initiates the erasing of the data contained in the user's portion of the processor memory. The controller must be stopped (SUPV 1) before memory is cleared.
REAL TIME	4	Displays power flow as it is updated by controller scanning. Fast changing power flow is accurately displayed. Scan time is slightly increased.
DUMP MEMORY	5	Initiates the loading of the user's portion of the processor's memory into the program pack.

Before pressing the ENTER key a second time, the DATA display area reads CONF (confirm). Pressing the ENTER key a second time causes the command associated with the supervisory code to be performed. The REFERENCE display area contains SUP "n" where "n" is the code of the command being processed. When the supervisory function is completed the DATA display reads DONE.
The supervisory mode can be exited in three ways:

- Entering supervisory Code 0 and pressing the ENTER key causes the programming panel to enter the EXAMINE mode.

- Pressing the RESET key causes the programming panel to enter the EXAMINE mode. The cursor returns to the position it was in prior to entering the Supervisory mode.

- Pressing the SHIFT key and then the RESET key resets the panel and returns the cursor to the power-up "home" position (row 1, column 1) in the EXAMINE mode.

6.3.4.4. CLEAR

When pressed in the DATA ENTRY or EXAMINE mode, the CLEAR key places 0000 in the DATA display, blanks the ELEMENT TYPE display and leaves the panel in the DATA ENTRY mode.

In SUPV and ERROR modes, the CLEAR key is not operational.

6.3.4.5 HOLD

When pressed, the HOLD key causes the updating of the DATA display to cease and the most current data or status to be "held" in the Data display. The Hold state is visually indicated by an uppercase or lowercase H in the leftmost character position of the Data display. An uppercase H is displayed if the most significant digit of the numeric value being displayed (leftmost number) is 1. A lowercase h is displayed if the most significant digit is 0.

The HOLD key is functional in the EXAMINE mode.

Pressing any key causes an exit from the Hold state.

6.3.4.6 RESET-SHIFT/RESET

The RESET and SHIFT/RESET keys are the only keys that can be used after an error or after a search is completed. Pressing RESET will cause the panel to return to the EXAMINE mode at the current cursor position. If the error condition still exists, an error message will reappear. Certain panel or controller diagnostic and communication error states can only be exited by a SHIFT/RESET (see Appendix A).

In all modes, RESET has the same effect as described above. It overrides any existing mode and brings the panel back to EXAMINE mode at the node for the current cursor position.

SHIFT/RESET has the effect of restarting the panel, and is equivalent to a power-up. Full diagnostics are run and, if passed successfully, the panel enters EXAMINE mode at network 1, row 1, column 1.

18

6.3.4.7 REF-SHIFT/PREVIOUS REF

Depending on the current panel operating mode, pressing the REF (reference) key causes one of several actions:

Enter Mode — While in the Enter mode, pressing the REF key, after entering a reference number into the DATA display (via the keyboard), causes that reference number to appear in the REF display. The DATA display continuously shows the data or status of the new reference number.

Examine Mode — Pressing the REF key while in the EXAMINE mode causes the reference number in the REF display to increment by one, and the data or state of the new reference number to appear in the DATA display. Entry of an invalid reference number causes an error code to appear in the DATA display.

In the SHIFT mode, pressing the REF key causes the PREVIOUS REF command to occur. This decrements the reference number viewed in the REF display by one, and the data or state of the new reference number appears in the DATA display.

The programming panel is aware of the controller's memory size and automatically provides wraparound if incrementing or decrementing the reference number exceeds the maximum limit. Any reference number may be used. For sequencer reference numbers, incrementing, decrementing, and wraparound effect only the two righthand digits.

If the input logic element being examined is disabled, the DATA display indicates the condition by placing a small "d" in front of the "ON" or "OFF" mnemonic. Output coils will show only their ON or OFF condition and not if they are disabled. The disabled condition of a coil can be determined in EXAMINE mode when the cursor is on the coil.

While examining a reference, the power flow display and the Element Status light continue to show the power condition at the cursor position previous to the initiation of the REF mode. The Element Type display goes blank when the REF key is pressed.

6.3.4.8 NET-SHIFT/PREVIOUS NET

The NETwork key is used to access a desired network. This key operates in any of the following three modes: Pressing the NET key causes the next network in sequence to be selected, displays the new power flow information, and increments the NETWORK display number. If the last network is being viewed and the NET key is pressed, the first network (1) is selected (wraparound).

Any network can be displayed by entering a valid network number (1-18) into the DATA display and then pressing the NET key. The network requested appears in the POWER FLOW display and the new network number appears in the NETWORK display.

Pressing the NET key while in the SHIFT mode causes the previous network in sequence to be selected, and displays the new power flow information, and decrements the NETWORK display number. If the present network viewed is network 1 and SHIFT/NET is pressed, the last network is accessed (wraparound).

In all cases, the accessed network places the cursor in the home position (row 1, column 1) and displays the new power flow information.

6.3.4.9 SRCH-SHIFT/CONTINUE SRCH

The SEARCH function enables a search through the logic networks for the occurrence of a specific reference number or node type. There are four types of search which are designated by parameters 1 to 4 as follows:

SEARCH TYPE	SEARCH DESCRIPTION
1	Search for a coil with a given reference number.
2	Search for a single node with a specified reference number.
3	Search for a double node which employs a register with a specified reference number. This includes implied references associated with adders and subtractors.
4	Search for a given node type. This search looks only for the basic node type regardless of the existence of verticals or latches.

To use the SEARCH function, enter the desired search type into the DATA field and press the SRCH key. Next, enter the appropriate reference number or node and press the SRCH key a second time.

For example, to search for coil 0007; press the following keys:

1 [SRCH] 0007 [SRCH]

The search is started from Network 1, Column 1, Row 1 of the user logic and proceeds from Row 1 to Row 4 of each column and from column 1 to column 7 of each network through all the networks until the first occurrence of the reference or node is found. The search stops in EXAMINE mode with the cursor on the node which has just been found.

Further occurrences of the specified reference or node can be looked for by pressing the SHIFT key and then the SRCH key. This continues the search. The Continue function is available only as the next step after a successful Search or Continue function. The only keys which can be pressed and preserve the Continue option are SHIFT, SEARCH, NET, and the CURSOR movement keys. A Continue function proceeds from the last found occurrence of the conditions, even if the cursor has been moved or the network number has been changed. A successful Continue operation leaves the panel in the EXAMINE mode with the cursor at the discovered node and the SHIFT ON.

If a Search or Search Continue operation proceeds to the end of the user logic without finding an occurrence of the specified conditions, error code 79 is displayed and the cursor is returned to its position immediately prior to starting the current Search or Continue operation. The SHIFT state is removed, if present.

6.3.4.10 ENTER

The ENTER key allows the user to enter initial information or change existing information associated with the node at the cursor's current

position. For single node functions the initial or altered information can be the reference number, element type, and vertical or horizontal connectors. For double-node functions, entry of initial information involves both the upper and lower nodes; changing existing information may involve only the upper or the lower node or both nodes.

Entering a Single-Node Logic Element

Any combination of allowable numeric values (reference numbers, preset values, etc.) and logic elements (contacts, coils, timers, etc.) can be entered for a single-node logic element. As soon as any numeric or element key is pressed, the controller goes into the ENTER mode. The last value entered for either the numeric value or logic element prior to pressing the ENTER key is the one that is valid and is entered into the controller (for example, after entering a normally closed contact, the user can have a change of mind and enter a normally open contact). There is no preferred sequence for entering numeric values and logic elements. When all the information is correct, press the ENTER key.

For example, to enter a normally closed contact with reference number 1017, place the cursor in the proper location, and press the following keys:

1017 [⊣/⊢] [ENTER]

The same sequence is required when changing the logic element (i.e., the reference number must be specified even if it is not changing).

Entering a Double-Node Logic Element

Double-node logic elements are characterized by numeric values that must be entered into both the upper and lower nodes. The upper node contains a preset value (0-999) or the reference number of the register that contains the preset value (300X or 40XX). The lower node contains the reference number of the holding register (40XX). Double-node logic elements must be entered in specific sequence. If this sequence is not followed, an error code will be displayed.

1. Position the cursor at the location of the top half of the double-node logic element.

2. Enter the preset value. The preset value appears in the DATA display area.

3. Enter the double-node logic element type (counter, T1.0, T0.1, +, −). When this is entered, the preset value moves from the DATA display area to the REFERENCE display area. The Element display area contains the selected logic element.

4. Enter the reference number of the holding register (accumulated time, accumulated count, or overflow). Vertical connections can be entered also.

5. Press ENTER.

Example

To define a double-node logic element:

```
010
T1.0
4020
```

Place cursor in upper node location and press the following keys in sequence:

010 [SHIFT] [T1.0] 4020 [ENTER]

Logic Element Entry Rules

The following rules and restrictions apply when entering logic element information.

1. Logic coils cannot be entered directly over existing double-node logic elements (error code 92). A coil can be entered over a single-node logic element (the overwritten logic element is deleted and replaced by the coil).

2. A double-node logic element cannot be entered over a coil.

   In both cases above, the logic element to be replaced must first be erased by entering a horizontal open.

3. A double-node logic element can be entered over another double-node logic element or any logic element in the upper node position. To replace a logic element, the lower node must be a horizontal open. A double-node logic element cannot be entered where obliteration of one-half of another double-node logic element would occur (error code 92).

4. A double-node logic element cannot be entered where the lower node extends below the bottom rung of a network (error code 93).

5. A contact can be entered over a double-node logic element (either the upper or lower node). The other node is replaced by a horizontal open.

6. No vertical connectors can be entered in the bottom rung or in the seventh column.

7. Out of range or inappropriate reference numbers or preset values cause an error code (94) to appear.

8. A logic coil with a given reference number can occur only once in the user's logic. An attempt to write one results in error code 93. A logic coil reference number can be assigned to one or more contacts. The logic coil can then not only be used as a discrete signal to an output device, but also as a control for other user logic (for example, the latch in a seal circuit).

9. No data can be entered if the Memory Protect Switch is ON.

10. Any logic coil, whether disabled or enabled ON or OFF, is set to OFF when it is deleted by being replaced by another logic element.

6.3.4.11 SHIFT/ENTER VALUE

The SHIFT/ENTER VALUE function allows the user to insert a value into a register or to change the contents of a register. To use this function, first make sure the appropriate register reference number appears in the REF display. Using the numeric keypad, enter the desired value (0-999) for the contents of the register.

The new register contents appear in the DATA display. Enter the contents into the register by pressing the SHIFT and ENTER keys sequentially.

To enter or change the contents of register 4021, position the cursor in the proper location, and press the following keys:

4021 [REF] nnnn [SHIFT] [ENTER]

where nnnn is the value of the register contents being entered.

6.3.4.12 DISABLE (SHIFT/FORCE)

The DISABLE (SHIFT/FORCE) function allows the user to disable a coil or an input. To disable a coil, the cursor must be positioned on top of the coil. To disable an input, the REF display must contain the reference number of the input logic element. When the SHIFT and FORCE keys are pressed, the input is either enabled or disabled, depending upon its previous state. If the new status is disabled, a "d" appears to the left of the status in the DATA display (dOFF or dON). If a coil is disabled, the Node display reflects the current power status.

To re-enable the logic element, press the SHIFT and FORCE keys a second time.

6.3.4.13 FORCE-SHIFT/DISABLE

The FORCE key is used to toggle the power status of a previously disabled coil or input. When the FORCE key is pressed and the REF display contains a disabled input (10XX), or the cursor is on a disabled coil (00XX), the DATA display shows the power status of the element.

6.4 MEMORY PROTECT KEYLOCK SWITCH

A keylock switch is located on the front of the P370 Programmer. This hardware feature is designed to prevent accidental or unauthorized changes from being made to the user portion of memory using the programmer. It does not inhibit the normal operation of the controller but does prevent any changes from being made to the user program in the controller. All other programmer functions are available (i.e., element status can be checked, register contents can be monitored, etc.). When the key is vertical, it can be removed and controller memory is protected. When the key is inserted and is in the horizontal position, controller memory is unprotected and changes to the user program can be made from the P370 Programmer. (User memory can be changed at any time using the Program Pack (see Section 8).)

6.5 PROGRAMMER OPERATIONS

Tables 6-2 through 6-4 provide a quick reference for each of the four programming panel operating modes and:

1. The liquid crystal displays active during each mode.
2. The function keys operational during each mode.
3. The function keys used for panel mode entry.

Table 6-2. LCD Displays During Panel Modes

DISPLAY AREA	PANEL MODE			
	EXAMINE	ENTER	SUPERVISORY	ERROR
NETWORK	Displays current network number	Displays current network number.	SUP4:Displays current network number. Others: Blank	Contains network number in which error occurred.
REFERENCE	Displays Reference Number or Preset Value	Blank or displays preset data just entered.	SUPX = Supervisory Code	Blank
DATA	If Reference field contains 00XX, 10XX, or 2RXX, displays H or h if in Hold mode, d if Disabled, ON or OFF for state if register ref displays 000-999.	Blank or displays data just entered.	1. Blank until command initiated, -Reads CONF (after first ENTER) then Reads DONE (after second ENTER)	Exy = Error Code
Power Flow and Cursor	Normal Power Flow Cursor	Normal Function	SUP4: Real-time power flow and cursor movement Others: Blank	Blank
Element Type	1. If monitoring node at cursor position, the node graphic is displayed. 2. No display if monitoring a reference not associated with cursor.	Blank or displays logic element just entered.	Blank	Blank
COMM OK	Normal Function:	ON for good communication, off for bad communication		
SHIFT	Normal Function:	ON if Shift key is depressed		
ENTER	Blank	ON	Blank	Blank
EXAMINE	ON	Blank	Blank	Blank
Element Status LED	Normal Function	Normal Function Function Others: Blank	SUP4: Normal Function	Normal

Table 6-3. Key Usage/Panel Mode

MODE	SHIFT RESET	RESET	CLEAR	SUPV	ENTER	NUMERICS	CURSOR	HOLD	ALL OTHERS
Examine Mode	X	X	X	X	X	X	X	X	X
Enter Mode	X	X	X	X	X	X	X		X
Supervisory Mode	X	X		X	X	X	X		
User Error	X	X							
Panel/Controller/ Communication Errors	X								

Table 6-4. Panel Mode Entry

FROM	TO: EXAMINE	SUPERVISORY	ENTER	HOLD STATE
Enter	Press ENTER, RESET, or SHIFT/ RESET	Press SUPV Key	N/A	N/A
Supervisory	Press SUPV, 0 and ENTER, or RESET, or SHIFT/ RESET	N/A	N/A	N/A
Error	Press RESET or SHIFT/RESET	N/A	N/A	N/A
Hold State	Press any key except logic element numeric, or CLEAR	Press SUPV	Press any logic element, numeric, or CLEAR	N/A
Examine	N/A	Press SUPV	Press any logic element, numeric, or CLEAR	Press HOLD

SECTION 7
PROGRAMMING THE MICRO 84

The basic element used in programming the MICRO 84 Programmable Controller is the contact. A contact can be either normally open or normally closed. Associated with each contact is a logic element (indicating whether the contact is normally open or normally closed) and a reference number. The reference number ties the logic element to a specific connection on the I/O input module. The input used to control the status of a contact is called a discrete input (i.e., it turns the contact either to the non-normal condition or returns it to the normal condition).

Another type of input that can be used is numeric data. This information is stored in an input register. Each register also has an associated reference number.

A coil is another logic element and its state (energized or de-energized) is determined by the various inputs that control it. A coil is an output used to control a specific piece of user equipment or as input to another network. Each coil is associated with a specific reference number.

7.1 NETWORKS

In the MICRO 84, each program element occupies one or two "nodes". The nodes are arranged so that seven elements can be entered horizontally (a rung on the ladder). Up to four rungs can be combined to form a network. A network then, is the ladder diagram program. The number of logic elements that can be contained in a MICRO 84 depends upon the complexity of the networks and the memory size of the controller. Figure 7-1 illustrates a typical multi-node network.

7.2 SOLVING NETWORK LOGIC

The MICRO 84 function is to "solve" the ladder logic networks. To do this, it "scans" the various elements of a network, checking the state of each input element (are contacts open or closed, etc.) and setting the status of the output coils accordingly. In performing its scan of a network, the MICRO 84 checks the status of the leftmost COLUMN of elements first and then proceeds COLUMN by COLUMN to the right until the network is "solved". An element in Row 3, Column 4 is scanned (and solved) before an element in Row 1, Column 6. The output of the first element can be used as input to the second element. Figure 7-2 illustrates the sequence the controller uses in solving a network.

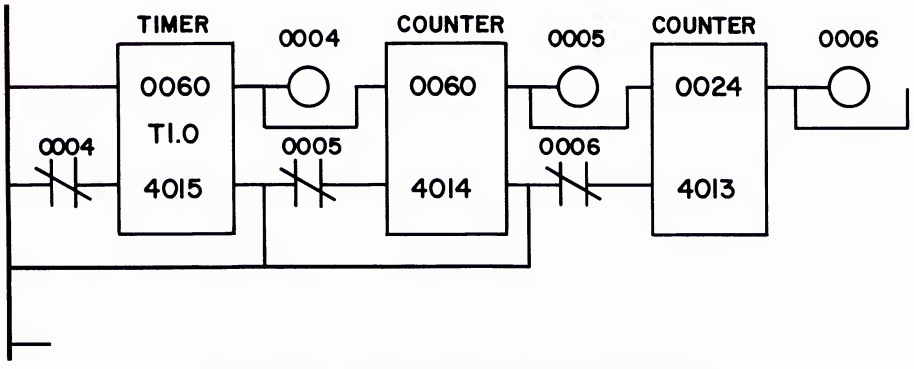

Figure 7-1. Typical Multi-Node Network

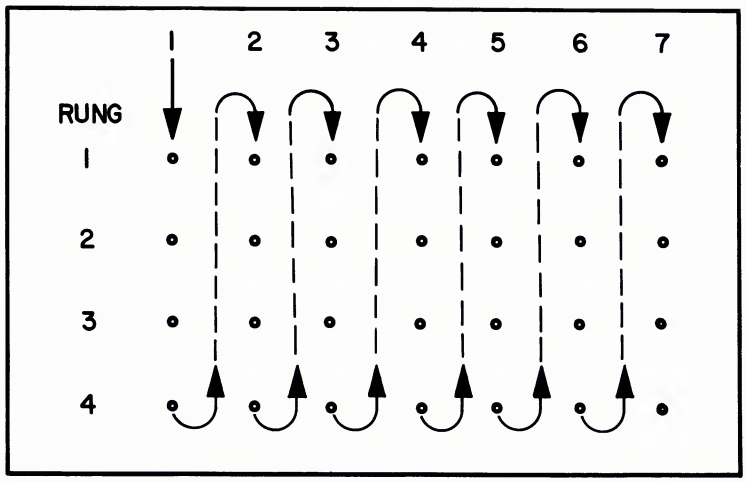

Figure 7-2. Network Solving Sequence

Because the MICRO 84 solves a network in a particular fixed sequence, it is possible to arrange the logic elements in such a way that the status of a coil can be used as discrete input to a contact in a column further to the right than the coil (see Figure 7-3). The status of a coil also can be used as discrete input to another network.

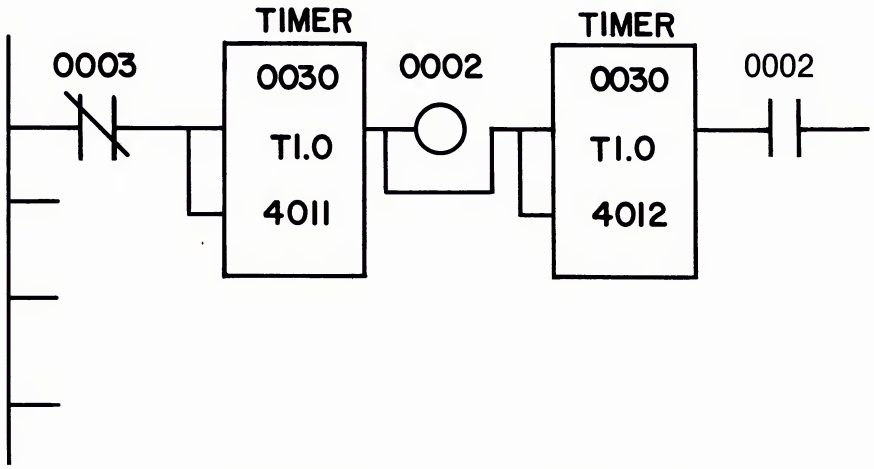

Figure 7-3. Coil Used as Discrete Input

7.3 NETWORK POWER FLOW

Within a network, power flow is from left to right, bottom to top, or top to bottom. When displayed on the LCD programming panel, power flow is indicated for all contacts by illuminating those contacts that are passing power from left to right.

7.4 LADDER LOGIC PROGRAMMING PAD

A Ladder Logic Programming Pad has been designed and is available for use in planning and documenting ladder logic programs. Figure 7-4 shows the format of the pad.

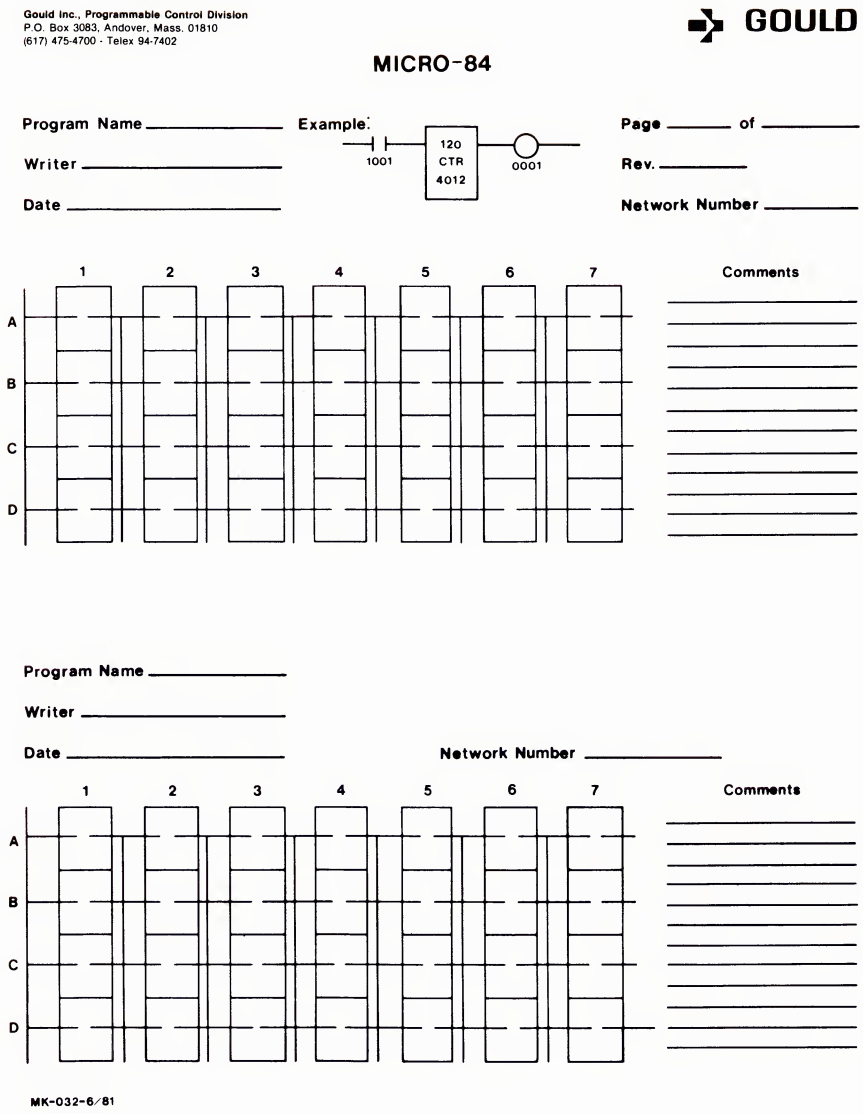

Figure 7-4. Ladder Logic Programming Pad

7.5 REFERENCE NUMBERS

In the programming of the MICRO 84 Programmable Controller, four digit reference numbers are used in building the program logic. These reference numbers are divided into three broad categories: discrete, register, and sequencer. Discrete references are used for items that can be either ON or OFF, such as contacts, pushbuttons, motor starters, relay coils, limit switches, solenoid valves, etc. Register references are used to store numeric values such as counters, timers, analog values, etc.; all registers can store numbers that are three decimal numbers long (0-999). These numbers are stored in binary-coded decimal (BCD) format. Sequencers operate like stepping drum rotary switches with a single reference contact at each position of the stepping switch. Sequencer operations are controlled by numeric values placed in specific registers (see "Sequencers" (Drum Programmers) later in this section).

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Any specific reference number can be used as many times as required throughout the logic except for a coil. A coil can be used as an output only once but can be used as many times as desired as an internal contact. Reference numbers are defined as follows:

Type	Reference Number M84-001	Reference Number M84-002
Coils and discrete outputs (lights, solenoids) or internal contact	0001-0032	0001-0064
Input registers (numeric data)	3001-3004	3001-3004
Sequencers	21XX-28XX XX-Step (01-16)	Same
Usable as sequencer registers	4001-4008	4001-4008
Discrete inputs (contacts, pushbuttons)	1001-1032	1001-1064
Internal registers (numeric data)	4001-4020	4001-4032
Output registers	4010, 4012, 4014, 4016	4010, 4012, 4014, 4016, 4018, 4020, 4022, 4024

7.6 PROGRAMMING FUNCTIONS

The MICRO 84 Programmable Controller provides the capability to program or simulate the operation of relay contacts, timers, sequencers, counters, and arithmetic functions. All programming is done on the basic format of up to seven elements in each horizontal row or rung. A network can be a single rung, two rungs, or up to four rungs. Relay type elements occupy a single node position within a network and non-relay type elements (counters, timers and arithmetic operations) occupy two vertically oriented node positions within a network.

Data is entered directly into the memory of the controller (it is not stored in the programming panel). If AC line power is interrupted prior to completion of the programming, whatever data has been entered is retained. No additional operations are required; whatever data the user enters is the data stored for use by the controller.

Network elements can be added, deleted, or changed at any time using the programming panel. The logic changes do not interrupt the controller's operation. In addition, the effect of any coil (input or output) on system operation can be tested by simulating inputs and outputs using the MICRO 84's disable feature.

7.6.1 Basic Programming Elements

The basic programming elements are the contacts, coils, and connectors shown below:

7.6.1.1 Normally Open Contact

The normally open contact is the basic logic element point used in ladder logic diagrams. The logic element is controlled by a discrete input (reference number 10XX) or by a coil (reference number 00XX).

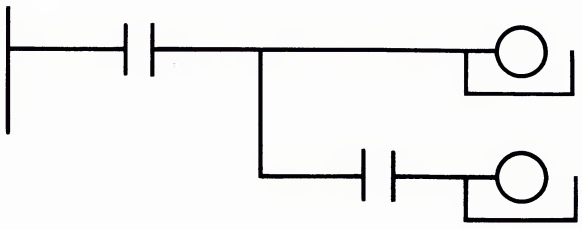
7.6.1.2 Normally Closed Contact

The normally closed contact is controlled the same way as a normally open contact.

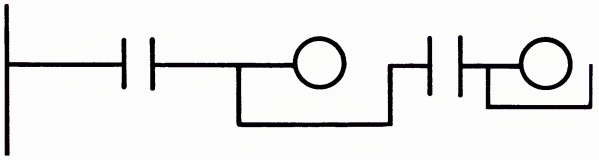
7.6.1.3 Coil

The coil (reference number 00XX) is the discrete output from ladder logic. A coil is used either to provide the control signal for an external discrete device (solenoid, motor starter, indicator lamp, etc.) and/or as the input for an internal contact. A coil can be programmed only once as a discrete output. Once programmed, it can be referred to as many times as desired as an internal contact.

More than one coil (unlatched or latched) can appear on a single rung. Each coil on a rung is treated as if it were connected to the right rail of the network. Therefore,



is programmed in the MICRO 84 as:



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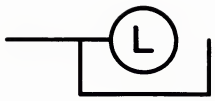
7.6.1.4 Latched Coil



The latched coil retains its state when power is removed (or fails). Normally, coils are reset to OFF upon power-up. A latched coil will not be altered and thus will retain the ON or OFF condition it had when power was removed.

7.6.1.5 Horizontal Connector

The horizontal connection is a short between two nodes on a ladder logic rung. The shifted horizontal connector is a horizontal open.

7.6.1.6 Vertical Connector

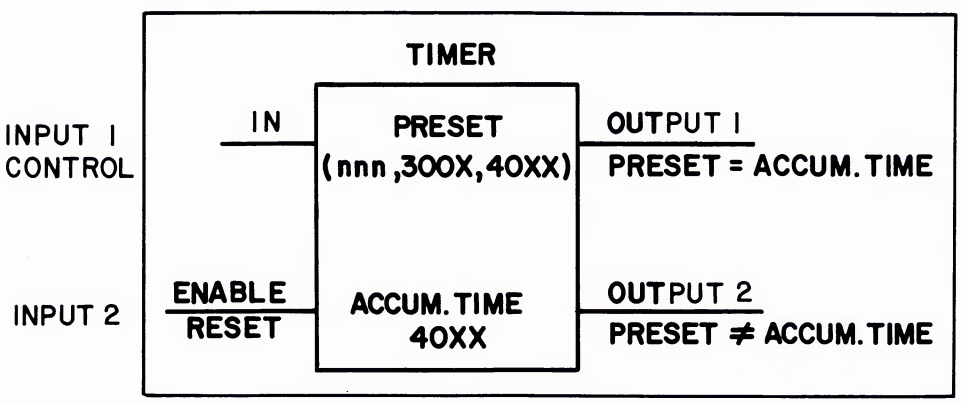
The vertical connector is a short between two rungs in a ladder logic network. The shifted vertical connector is a vertical open.

7.6.2 Timers

Two timer rates are provided in the MICRO 84: one second and one tenth of a second. These internal timers can be used to create as many logic program timers as are necessary.

The timer content is not lost due to a power failure.

The one second timer (T1.0) is used to measure times between 1 second and 999 seconds. The one tenth of a second timer (T0.1) is used to measure times between 0.1 second and 99.9 seconds. The format of the timer element is shown below:



where:

Input 1

The timer is activated when power is connected to Input 1. A normally open contact is usually in this input line.

Input 2

The timer is enabled (able to be activated) when power is connected to Input 2 and is reset when power is removed. A normally closed contact is usually in this input line.

Preset

The upper element of the timer (preset) is used for setting the time period in seconds, or in tenths of seconds, that is to elapse before Output 1 is activated. The preset can be a fixed value (up to 999) or a register. When the preset is a register (reference number 300X or 40XX), the content of the register (a value up to 999) is used as the preset value. This register may be used by all timers having the same preset value.

Accumulated Time

The lower element of the timer must be a register (reference number 40XX) in which the actual (accumulated) time is stored. This "holding" register must be unique for this timer.

Output 1

Output 1 is a normally open circuit that becomes a closed circuit when the accumulated time equals the preset time. Remains closed until the timer is reset or until the equality no longer exists.

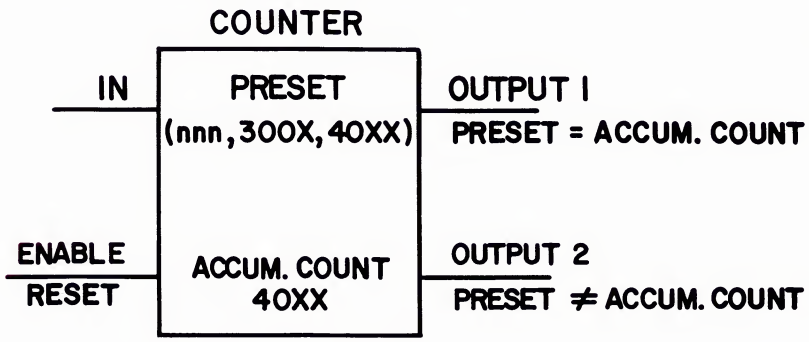
Output 2

Output 2 is a normally closed circuit that becomes an open circuit when the accumulated time equals the preset time. Remains open until the timer is reset or until the equality no longer exists.

7.6.3 Counters

The MICRO 84 contains circuits that simulate event counters. The counter increases its value by one whenever the input signal goes from OFF (de-energized) to ON (energized). Only on this positive transition (OFF to ON) is the count increased. Even if the input signal remains ON for several hours, it represents only one transition from OFF to ON and is thus only one count.

The format of the counter element is shown below:



The counter functions the same as the timer except that the preset value and the value being accumulated in the lower register are in terms of the number of times an event has occurred rather than the amount of time that has elapsed.

7.6.4 Cascading Timers and Counters

Timers and counters can be interconnected or cascaded to satisfy any required logic. As many timers and counters as necessary can be placed within a network limited only by the 4 x 7 logic element format.

Two timers (or counters) can be placed in series (interconnected) by using output 1 of one timer as input 1 to a second timer. These two timers allow twice as much time to be measured; they are cumulative in effect.

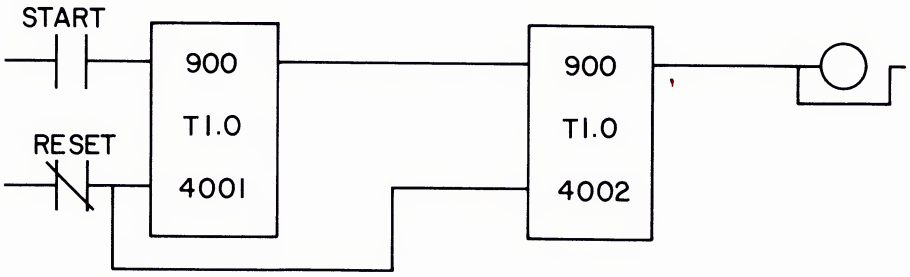
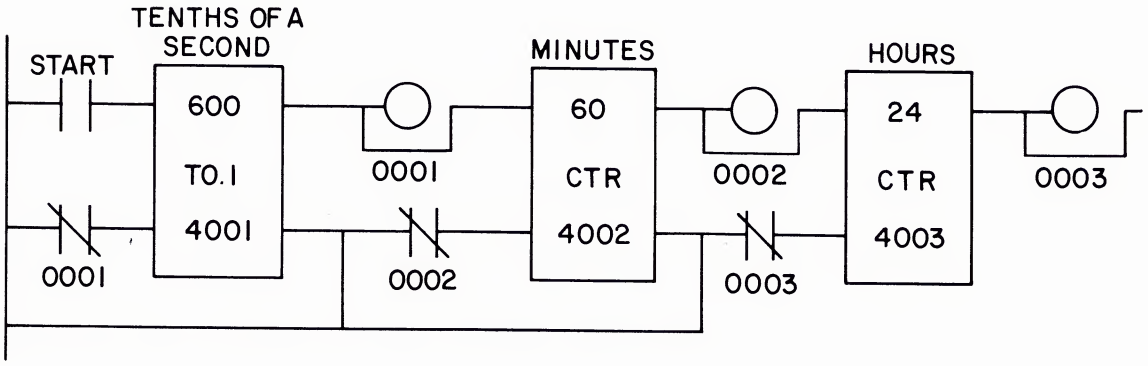


Figure 7-5. Interconnecting Timers

Timers and counters can also be cascaded to, in effect, multiply their range. Figure 7-6 illustrates a timer/counter network that produces a time-of-day clock measuring time in hours and minutes.



NOTE

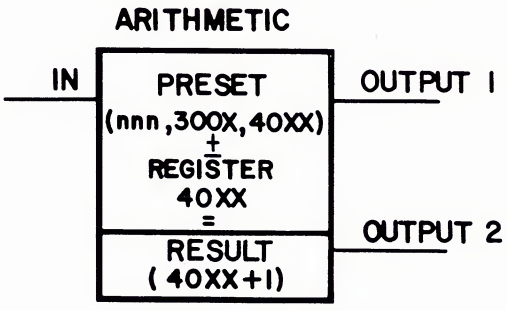
For greater long-term accuracy, adjust timer between 598 and 602 using an accurate clock.

Figure 7-6. Time-of-Day Clock

7.6.5 Arithmetic Operations

The arithmetic operations consist of addition and subtraction.

The format of the arithmetic operations is shown below:



where:

Input

The arithmetic operation is performed when power is connected to the input. The input circuit is normally open.

Preset

The upper element of an arithmetic operation is a preset value. The preset can be a fixed value (up to 999) or a register. When the preset is a register (reference number 300X or 40XX), the content of the register (a value up to 999) is used as the preset value.

Holding Register

A register that holds the result of another logic operation (reference number 40XX).

Result Register

A register in which the answer to the arithmetic operation is stored. The MICRO 84 automatically assigns a reference number to this register. The number assigned is the holding register reference number plus one (e.g., 40XX + 1). When assigning a reference number to a holding register, make sure that there is an unassigned reference number, one larger than the one being assigned, for use by the controller.

Output 1

The status of the output is determined by the result of the arithmetic process.

Output 2

The status of the output is determined by the result of the arithmetic process.

NOTE

An output is energized only if the input is also energized. When power is removed from the input, the output is de-energized.

7.6.5.1 Addition

The addition function adds the preset value to the contents of the holding register and stores the result in the result register. Based on the results of the addition, one of two output conditions exists:

- If the sum exceeds 999, Output 1 is energized (Output 2 is de-energized) and the remainder (the sum minus 1000) is stored in the result register.
- If the sum is less than 999, Output 2 is energized (Output 1 de-energized).

NOTE

The result register contains only the result of the latest calculation.

7.6.5.2 Subtraction

The subtraction function compares the value in the preset with the value in the holding register and places the value of the difference in the result register. Based on the results of the compare, one of three output conditions exists:

- If the preset is greater than the holding register, Output 1 is energized (Output 2 de-energized).
- If the preset is less than the holding register, Output 2 is energized (Output 1 de-energized).
- If the preset is equal to the holding register, both Output 1 and Output 2 are energized.

7.6.6 Sequencers (Drum Programmers)

The MICRO 84 Programmable Controller can be used to produce a drum type programmer on a circumferential row-by-row (sequencer) basis. Each circumferential row can operate independently or dependently with reference to the surrounding rows. The controller can contain up to eight sequencers with up to sixteen contacts for each. Reference numbers for sequencer contacts start with the digit 2 and are in the form 2RXX. The significance of the remaining three digits of a sequencer contact reference number is as follows:

Sequencers are controlled by the value (00-16) that is contained in a sequence register (reference numbers 4001-4008).

Sequencer Register Reference Number: 400Y

Sequencer Contact Reference Number: 2RXX

where:

R = 1 thru 8 (Sequencer reference register number 4001-4008)

XX = 01 thru 16 (Sequencer contact number)

Sequencer operation is controlled by a numeric value (1 thru 16) placed in a specific sequencer register (4001-4008) by any of the non-relay devices such as a counter, timer, or arithmetic operation. The value placed in the sequencer reference register results in a single sequencer contact (2RXX) being energized (contact closes). All other contacts are de-energized. As an example, refer to Figure 7-7.

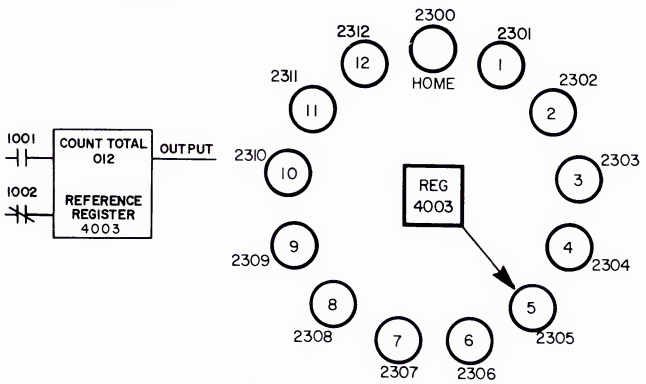


Figure 7-7. Sequencer Example

Each time input "count" contact (1001) is closed, the value in register 4003 increases by one. This is equivalent to moving the stepping switch one position (clockwise). If register 4003 contains the value five, sequencer contact 2305 is energized. When input 1002 is energized, the counter is reset to zero and the stepping switch goes to home position (no contacts closed).

Each sequencer is completely independent since each is controlled by a separate register (4001-4008). Each sequencer contact reference number (2RXX) can be used one or more times anywhere in the logic where a contact is appropriate.

By using various logic techniques, any sequencer can be made to skip steps and to jump forward or backward as necessary. Only one sequencer contact (per sequencer) is in effect at any one time (i.e., contact points between the jump points are not affected by the jump). The keystrokes required to program a typical sequence are given in Appendix B.

SECTION 8
USING THE P371 PROGRAM PACK

The MICRO 84 P371 Program Pack (see Figure 8-1) incorporates a memory that is identical to the user's portion of the controller memory. It is this portion of the controller memory that contains the user-generated logic program. The program pack allows the user to dump (store) this logic program for use as a backup to the current system. The program pack also allows a logic program generated on one controller to be transferred (loaded) into another controller with a minimum of effort.

NOTES

Only the user-generated logic program is dumped to the program pack. The contents of all holding registers, and the redefinition of the A and B keys are not transferred.

Be sure the Program Pack used matches the controller (i.e., only use the 1K P371-001 with M84A-001 and the 2K P371-002 with M84A-002).

Before transferring the user's logic program, the MICRO 84 automatically erases the memory that is to receive the program (e.g., when dumping a logic program to the program pack, the first step that the controller performs is to erase the memory in the program pack).

Figure 8-1. Program Pack

8.1 P371 PROGRAM PACK INSERTION

The program pack fits into a slot in the bottom of the MICRO 84 Controller. Insert the male connector on the program pack into the slot on the controller. Push on the base of the program pack so that it mates firmly with the controller. When not actively using the Program Pack, remove it from the controller and store it in a safe place. Do not press the orange button while inserting the pack into the mainframe.

NOTE

When recording and then reloading a program into the same controller, remove the P371 Program Pack and then reinsert it before loading the program. This procedure prevents the occurence of false error conditions.

8.2 DUMPING (STORING) A PROGRAM TO THE P371 PROGRAM PACK

Dumping a user's logic program from the MICRO 84 controller to the program pack is initiated by a sequence of keystrokes entered into the P370 programmer. The necessary steps and keystrokes to dump a program are given below.

1. Enter the Supervisory mode and stop the controller (controller RUN light goes out).

SUPV 1 ENTER ENTER

2. Dump the user's logic program into the program pack. During this process, the WRITE light on the program pack illuminates.

5 ENTER ENTER

Wait until the WRITE light goes out before proceeding.

3. Restart the controller. The controller's RUN light illuminates.

2 ENTER ENTER

4. Return the P370 Programming Panel to the EXAMINE mode.

RESET

8.3 LOADING A PROGRAM FROM THE P371 PROGRAM PACK

The button located on the program pack's bottom activates the transfer of program data from the program pack to the controller.

1. Pressing the button once causes the following action:

   a. The controller stops, turning off the RUN light on the controller.

   b. Initiates the program data transfer. After the data is transferred, the DONE light, located on the program pack, turns on.

      If the DONE light does not turn on, it indicates that the load was not successful. Retry loading.

2. Pressing the button the second time causes the following action:

   a. The DONE (green) light turns off.

   b. The controller's RUN light turns on, indicating that the controller has restarted.

3. If the P370 Programmer was attached during the loading sequencer, press SHIFT/RESET. This is necessary so that the programmer can reflect the new controller logic.

APPENDIX A
ERROR CODES

When the MICRO 84 system detects an error, the letter E and the corresponding error code (00-99) appear in the data display. The system detects errors in both the controller and the programmer. Controller errors (e.g., communications, logic, etc.) require that the controller be restarted. This is accomplished using the SHIFT and RESET keys on the programmer. Programmer errors (e.g., an illegal sequence of keystrokes is entered) require using the RESET key only.

Table A-1 lists the error codes, their meaning, and remedy. The asterisk that follows some of the error codes indicates that the error is a controller error. The other errors are P370 Programmer errors.

Table A-1. Error Messages

ERROR CODE	MEANING	REMEDY
60*	A diagnostic error has occurred in the controller's RAM or ROM memory.	1. Restart Controller—(SHIFT/RESET) If the error does not reoccur, system is OK. 2. If the error reoccurs after restarting and user logic was just loaded from a program pack, reload making sure the program pack is correctly and firmly inserted. If the error reoccurs, clear the controller memory (SUPV3) and restart controller (SUPV2). If controller runs (RUN light on), program pack contains garbled logic or pack itself is bad. Reload program pack with known good logic and reattempt. Could also be caused by using the wrong program pack/controller combination (memory size mismatch). 3. If error reoccurs after attempting to restart, and program pack has not been used to load new logic, a hardware problem exists (call your distributor).
61*	An error has occurred in the Input/Output section of the controller.	1. Check to ascertain proper installation of terminator plug (see Section 3). Retry. 2. Bad controller. Remove all I/O modules, insert terminator plug in controller. Retry. If no error, controller is good. 3. Bad I/O module. Reinstall the modules (and terminator plug) removed in step 2 one at a time, and retry. Error will occur when faulty I/O module is installed. Replace the module.
*To clear errors with an asterisk, press SHIFT/RESET; errors without an asterisk, press RESET. (All errors can be cleared using the SHIFT/RESET sequence.)		

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Table A-1. Error Messages (Cont)

ERROR CODE	MEANING	REMEDY
62*	An error is detected in user logic during the power up sequence.	1. Reattempt to start the controller from the programmer (SHIFT/RESET). 2. Reload the user logic from the program pack. 3. Clear controller memory (SUPV1, SUPV3, then SUPV2 and reprogram the controller.
63*	A message from the programmer to the controller arrived garbled.	1. Check cable connections between programmer and controller and retry. 2. Retry using another programmer.
64*	A message sent by the programmer has taken too long to get to the controller.	1. Check cable connections between programmer and controller and retry. 2. Retry using another programmer.
65*	The transfer of user logic between the program pack and the controller (or vice-versa) was not successful.	1. Check that program pack is inserted correctly and retry. 2. When loading the controller, this message indicates that controller memory is bad. 3. When dumping to the program pack, this message indicates that program pack is faulty.
66*	Insufficient power (less than 100 (or 200) VAC).	If there is insufficient power, data cannot be entered into the controller (i.e., user logic cannot be altered). The controller will continue to function normally and the P370 Programmer will operate in the Examine, Supervisory, and Error modes.
67	An attempt has been made to disable a coil (00XX) and the cursor is not positioned on top of a coil.	Move cursor to appropriate element and retry. Coil contacts cannot be individually disabled. They are all disabled when the coil is disabled.
68	An attempt was made to force a coil or input contact that was not previously disabled.	Disable the element and retry.
70*	A message sent by the controller has taken too long to get to the programmer.	1. Check cable connections between the programmer and controller and retry. 2. Retry using another programmer.
71*	A message from the controller to the programmer arrived garbled.	1. Check cable connections between the programmer and controller and retry. 2. Retry using another programmer.

*To clear errors with an asterisk, press SHIFT/RESET; errors without an asterisk, press RESET. (All errors can be cleared using the SHIFT/RESET sequence.)

Table A-1. Error Messages (Cont)

ERROR CODE	MEANING	REMEDY
73*	A diagnostic error has been detected in the programmer ROM.	This error may occur when a programmer is plugged into the controller for the first time. Press SHIFT/RESET. If the error reoccurs, try another programmer.
75*	A diagnostic error has been detected in the programmer RAM.	Try another programmer.
76	An illegal sequence of keystrokes was entered for a Search	The proper sequence is: Search Type, SRCH key, Reference Number (or Element Type), SRCH key.
77	An illegal Search Type code or Reference Number was entered in a Search request.	Retry using proper Search Type code and Reference Number.
78	An attempt has been made to Search without specifying a Search Type code or Reference Number.	Retry using proper Search Type code and Reference Number.
79	The search for the specified logic element was unsuccessful.	Retry.
80	Illegal entry of vertical connector.	A vertical connector cannot be used in the fourth row or seventh column.
81	The controller was not stopped before function was attempted.	Controller must be stopped to either Clear or Dump memory.
82	An attempt was made to disable an element that cannot be disabled.	Only coils (00XX) and input contacts (10XX) can be disabled.
83	An attempt was made to enter a logic element but no logic element was included in the Enter sequence.	Retry using proper keystrokes.
84	An attempt was made to enter a logic element but no preset (double-node elements) and/or reference number was included in the Enter sequence.	Retry using proper keystrokes.

*To clear errors with an asterisk, press SHIFT/RESET; errors without an asterisk, press RESET. (All errors can be cleared using the SHIFT/RESET sequence.)

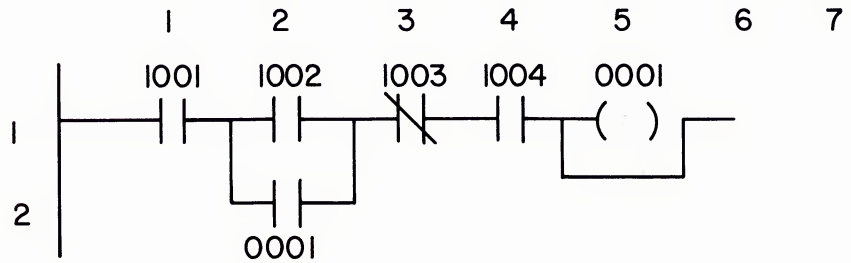
Table A-1. Error Messages (Cont)

ERROR CODE	MEANING	REMEDY
85	An invalid network number was entered.	The MICRO 84 can have 1-9 or 1-18 networks depending upon the memory size.
87	An out-of-range or invalid reference number has been entered.	Retry using a valid reference number.
88	The data value entered was greater than 999.	Retry using data value equal to or less than 999.
89	Memory is protected.	The keylock switch key is in the vertical position or has been removed.
92	Illegal entry of logic element was attempted.	See "Logic Element Entry Rules" in Section 6.
93	Double node logic element entered in an illegal position.	See "Logic Element Entry Rules" in Section 6.
94	A wrong reference number has been entered for an element type (e.g., a 40XX reference has been entered for a coil).	Correct and retry.
95	The same reference number has been entered for two coils.	Coil reference numbers must be unique. Retry using unique reference number.

APPENDIX B
PROGRAM LOGIC EXAMPLES

This Appendix contains several typical program logic examples including the ladder logic diagram and the actual keystrokes required to enter the logic into the MICRO 84 Programmable Controller. The keystrokes are entered using a P370 Programmer that is connected to the MICRO 84 mainframe. All examples start with the cursor in row 1, column 1.

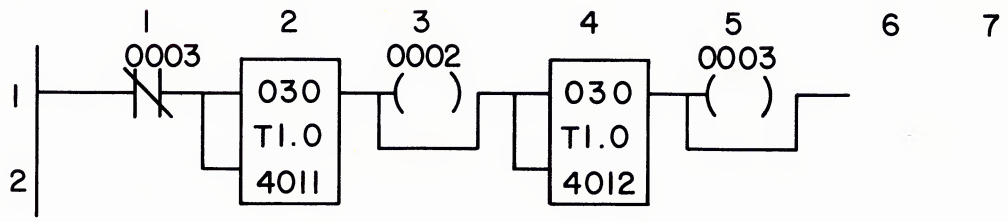
B.1 MOTOR CONTROL SEAL CIRCUIT



STEP	KEYSTROKES	COMMENTS
1	1001 [NO] [V] ENTER	Enter NO contact 1001 with vertical connector.
2	[→]	Move cursor to 1,2.
3	1002 [NO] [V] ENTER	Enter NO contact 1002 with vertical connector.
4	[↓]	Move cursor to 2,2.
5	0001 [NO] ENTER	Enter NO contact 0001.
6	[↑] [→] OR [→] [↑]	Move cursor to 1,3.
7	1003 [NC] ENTER	Enter NC contact 1003.
8	[→]	Move cursor to 1,4.
9	1004 [NO] ENTER	Enter NO contact 1004.
10	[→]	Move cursor to 1,5.
11	0001 [COIL] ENTER	Enter coil 0001.

B.2 OSCILLATOR

Coil 0002 is OFF for 30 seconds and then ON for 30 seconds.

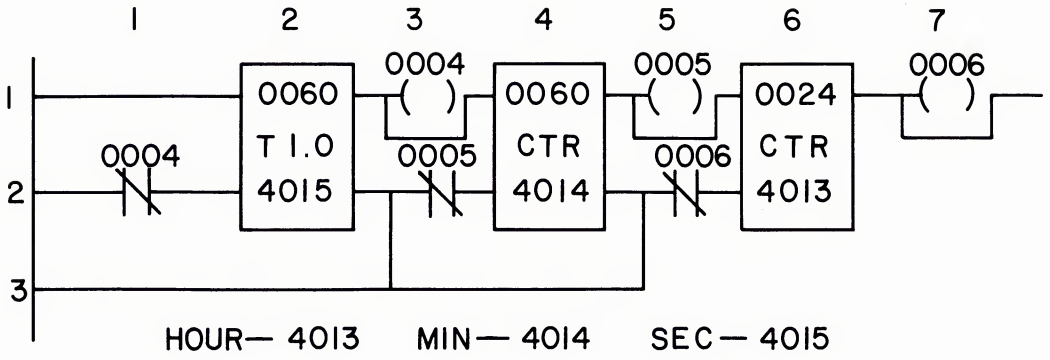


STEP	KEYSTROKES	COMMENTS
1	0003 [NC] [↕] ENTER	Enter NC contact 0003 with vertical connector.
2	[→]	Move cursor to 1,2.
3	0030 SHIFT T1.0 4011 ENTER	Enter 1 second timer 4011 with 30 second preset.
4	[→]	Move cursor to 1,3.
5	0002 [—o] [↕] ENTER	Enter coil 0002 with a vertical connection.
6	[→]	Move cursor to 1,4.
7	0030 SHIFT T1.0 4012 ENTER	Enter 1 second timer 4012 with 30 second preset.
8	[→]	Move cursor to 1,5.
9	0003 [—o] ENTER	Enter coil 0003.

To check oscillator operation:

10	4011 SHIFT DEFINE A	Define A key to 4011.
11	CLEAR	Clear data area.
12	A	Get 4011 and monitor timer.

B.3 REAL-TIME CLOCK

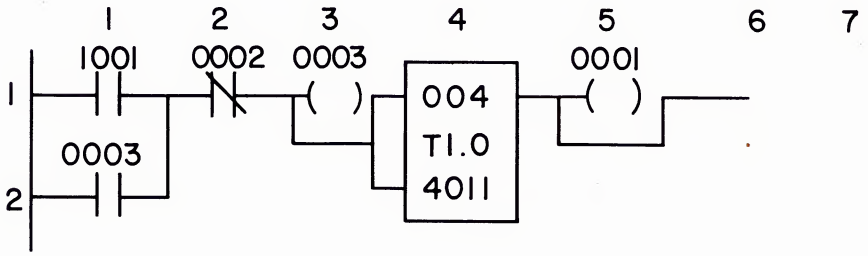


STEP	KEYSTROKES	COMMENTS
1	ENTER	Enter horizontal connector.
2		Move cursor to 2,1.
3	0004 ENTER	Enter NC contact 0004.
4		Move cursor to 3,1.
5	ENTER	Enter horizontal connector.
6		Move cursor to 1,2.
7	0060 SHIFT T1.0 4015 ENTER	Enter 1 second timer 4015 with preset of 60 seconds and vertical connector.
8		Move cursor to 3,2.
9	ENTER	Enter horizontal connection.
10		Move cursor to 1,3.
11	0004 ENTER	Enter coil 0004.
12		Move cursor to 2,3.
13	0005 ENTER	Enter NC contact 0005.
14		Move cursor to 3,3.
15	ENTER	Enter horizontal connector.
16		Move cursor to 1,4.
17	0060 SHIFT CTR 4014 ENTER	Enter counter 4014 with preset of 0060 (minutes) and vertical connector.

STEP	KEYSTROKES	COMMENTS
18	↓ ↓	Move cursor to 3,4.
19	⊶ ENTER	Enter horizontal connector.
20	↑ ↑ →	Move cursor to 1,5.
21	0005 —○ ENTER	Enter coil 0005.
22	↓	Move cursor to 2,5.
23	0006 ⊣/⊢ ENTER	Enter NC contact 0006.
24	↑ →	Move cursor to 1,6.
25	0024 SHIFT CTR 4013 ENTER	Enter counter 4013 with preset of 0024 (hours).
26	→	Move cursor to 1,7.
27	0006 —○ ENTER	Enter coil 0006.

B.4 TIME DELAY CIRCUIT

A four second delay occurs before coil 0001 is activated after pushing pushbutton 1001.

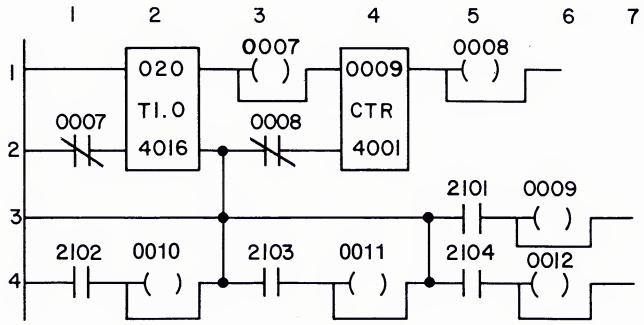


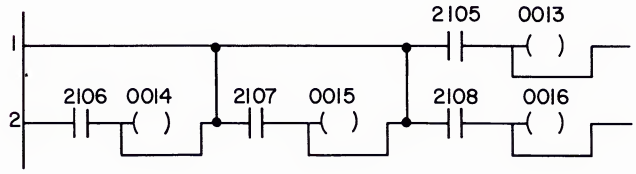
STEP	KEYSTROKES	COMMENTS
1	1001 ⊣⊢ ⊣ ENTER	Enter NO contact 1001 with vertical connector.
2	↓	Move cursor to 2,1.
3	0003 ⊣⊢ ENTER	Enter contact 0003.
4	↑ →	Move cursor to 1,2.
5	0002 ⊣/⊢ ENTER	Enter NC contact 0002.
6	→	Move cursor to 1,3.
7	0003 —○ ⊣ ENTER	Enter coil 0003 with vertical connector.
8	→	Move cursor to 1,4.

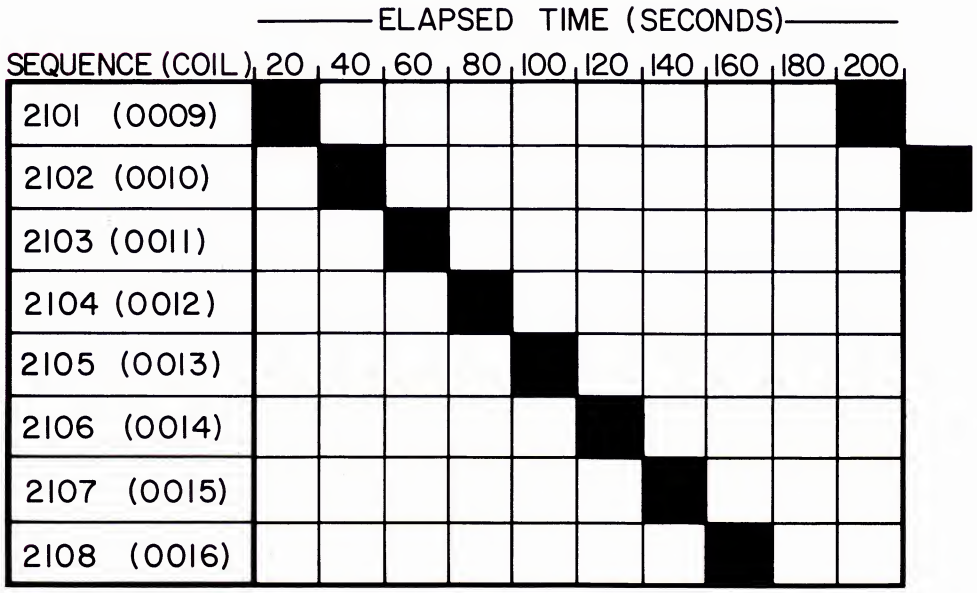
STEP	KEYSTROKES	COMMENTS
9	004 SHIFT T1.0 4011 ENTER	Enter 1 second timer 4011 with preset of 4 seconds.
10	→	Move cursor to 1,5.
11	0001 —○ ENTER	Enter coil 0001.

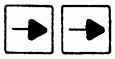
B.5 SEQUENCER (8 STEP)

This circuit sequentially energizes contacts (and consequently the attached coils) 2101 through 2108. The sequential contacts are made at 20 second intervals (see the chart below).







STEP	KEYSTROKES	COMMENTS
1		Enter horizontal connection.
2		Move cursor to 1,2.
3	020 SHIFT T1.0 4016  ENTER	Enter 1 second timer 4016 with preset of 20 seconds and vertical connector.
4		Move cursor to 1,3.
5	0007 	Enter coil 0007.
6		Move cursor to 1,4.
7	009 SHIFT CTR 4001 ENTER	Enter counter 4001 with preset of 9. 4001 is sequencer register and preset value is one more than the number of steps.
8		Move cursor to 1,5.
9	0008 	Enter coil 0008.
10		Move cursor to 2,1.
11	0007 	Enter NC contact 0007.
12		Move cursor to 2,3.
13	0008 	Enter NC contact 0008.
14		Move cursor to 3,1.
15		Enter horizontal connector.
16		Move cursor to 3,2.
17		Enter horizontal and vertical connectors.
18		Move cursor to 3,3.
19		Enter horizontal connector.
20		Move cursor to 3,4.
21		Enter horizontal and vertical connector.
22		Move cursor to 3,5.
23	2101 	Enter NO contact 2101 (sequencer step 1).

STEP	KEYSTROKES	COMMENTS
24	→	Move cursor to 3,6.
25	0009 —○ ENTER	Enter coil 0009.
26	→ → ↓	Move cursor to 4,1 (cursor wraps to column 1).
27	2102 ⊣⊢ ENTER	Enter NO contact 2102.
28	→	Move cursor to 4,2.
29	0010 —○ ENTER	Enter coil 0010.
30	→	Move cursor to 4,3.
31	2103 ⊣⊢ ENTER	Enter NO contact 2103.
32	→	Move cursor to 4,4.
33	0011 —○ ENTER	Enter coil 0011.
34	→	Move cursor to 4,5.
35	2104 ⊣⊢ ENTER	Enter NO contact 2104.
36	→	Move cursor to 4,6.
37	0012 —○ ENTER	Enter coil 2104.
38	NET	Go to next network. The cursor is in 1,1.
39	⊶ ENTER	Enter horizontal connector.
40	→	Move cursor to 1,2.
41	⊶ ⊢ ENTER	Enter horizontal and vertical connector.
42	→	Move cursor to 1,3.
43	⊶ ENTER	Enter horizontal connector.
44	→	Move cursor to 1,4.
45	⊶ ⊢ ENTER	Enter horizontal and vertical connector.
46	→	Move cursor to 1,5.
47	2105 ⊣⊢ ENTER	Enter NO contact 2105.

STEP	KEYSTROKES	COMMENTS
48		Move cursor to 1,6.
49	0013 	Enter coil 0013.
50		Move cursor to 2,1.
51	2106 	Enter NO contact 2106.
52		Move cursor to 2,2.
53	0014 	Enter coil 0014.
54		Move cursor to 2,3.
55	2107 	Enter NO contact 2107.
56		Move cursor to 2,4.
57	0015 	Enter coil 0015.
58		Move cursor to 2,5.
59	2108 	Enter NO contact 2108.
60		Move cursor to 2,6.
61	0016 	Enter coil 0016.

APPENDIX C
GLOSSARY OF TERMS

Arithmetic	A type of logic used to add or subtract two numeric values. The status of the two outputs is governed by the result of the arithmetic computation (addition overflow or subtraction comparisons).
Binary	A number system in which all values can be expressed by 1 or 0. In electronic hardware, the value 1 is the ON state of a circuit while 0 is the OFF state. Calculations can be made at a very high rate of speed using the binary number system and solid-state electronic hardware.
Binary Coded Decimal (BCD)	A number system where 4 binary (1/0 or ON/OFF) characters (or lines) represent a decimal digit (0-9). BCD is a recognized industry standard. BCD input devices (e.g., thumbwheels) and output devices (e.g., numeric displays) are readily available.
Bit	A single binary character.
Coil	A discrete output from the programmable controller. The output is normally used to energize a solenoid (provide power flow to the solenoid coil). Coils are turned OFF when power is removed (see Latch).
Counter	A type of logic used to count the occurrence of a particular event (a contact closing, a coil energized, etc.).
Disable	The capability of disconnecting a logic coil or a discrete input from control by program logic. In the disabled state, the logic element can be turned on and off using the program panel. This allows a system to be checked out element by element.
Discrete	Logic elements that can be either ON or OFF. Discrete elements can be input, output, or internal logic elements.
Dump	Recording the entire contents of user memory onto the Program Pack.
Element (Logic)	The basic building block of the MICRO 84 logic. An element is a contact, coil, connector, timer, counter or arithmetic function.
Force	A function on the P370 Programming Panel that can change the state of a disabled logic element from OFF to ON or vice-versa.
Input	A signal that provides information to the MICRO-84 controller. The input signal can be from a discrete device (pushbutton, relay contacts, limit switches, etc.) or from a numeric device such as a thumbwheel.
I/O	The communication between the MICRO 84 and the "real world" is called I/O (input/output). The I/O signals can be either discrete (ON or OFF) or numeric (register contents).
Latch	A coil that retains its state (ON or OFF) when power is removed and whose state is not reset when power is again available.
Logic Element	Any one of the elements that can be used in a ladder logic diagram. The elements include contacts, coils, shunts, timers, counters, and arithmetic functions.
Memory Protect	The capability of preventing unauthorized use of a P370 Programming Panel to make changes to the MICRO 84 Programmable Controller. When the key is in the OFF position or removed, user logic in the controller cannot be changed from the P370.

Module	An input/output device that passes signals between the "real world" and the controller. Modules used with the MICRO 84 can be either input or output, discrete or register. Modules are designed to be easily replaced with minimum system downtime.
Network	A group of connected logic elements used to perform a special function. A network can be from one element to a complete 4 x 7 matrix of elements.
Node	A point on a ladder diagram in which a logic element can be placed. A node can receive power from the left, top, or bottom and can pass power to the right, top, or bottom.
Output	A signal provided from the Controller to the "real world" that can be either discrete output (solenoid valve, relay, motor starter, indicator lamp, etc.), or numeric output (e.g., LED display).
Preset	The limit established for a counter or timer function. The current count or time available from the register referred to in the lower element cannot exceed this limit. At the preset value, the logic output is energized
Processor	The "brain" of the Controller system, wherein the user's logic and PC's executive is stored; all logic solving and decision making is performed by the Processor. Also called the CPU or mainframe.
Reference Number	Four-digit numbers used in the construction of the user's logic. Reference numbers can be either for discrete devices (logic coils, inputs, or sequencer steps) or for registers (input or holding).
Register	A location within the Controller allocated to the storage of numeric values (up to 999). All holding registers are retentive on power failure. There are three types of registers: input registers whose contents are controlled by the "real world" outside the Controller; holding registers whose contents are controlled from within the Controller; and output registers, which are special holding registers since their contents can also be provided to the "real world".
Remote Preset	The capability for placing the preset for a timer or counter into a register and referring to that register in the upper element of the logic. The preset is no longer fixed since the contents of the register (and thus the preset) can be altered at any time.
Run Light	An LED indicator on the Processor that indicates, when lit, that the logic is being processed.
Scan	The technique of examining or solving logic networks one at a time in their numeric order. After the last network is solved, the next scan begins at network one; logic is always solved in this fixed cyclic process.
Solid-State	Circuitry designed using only integrated circuits, transistor, diodes, etc.; no electro-mechanical devices such as relays are utilized. High reliability is obtained with solid-state logic, which would be degraded by depending upon electro-mechanical devices.
Timer	A logic element used to measure and record the time of an event or sequence of events. Timers can accumulate time in either seconds, or tenths of seconds.

APPENDIX D
I/O MODULE DATA SHEETS

This appendix is included to provide a place in which to store the I/O module data sheets that are packed with each module.

There are two types of modules that are available for use with the MICRO 84; discrete modules and register modules.

DISCRETE MODULES

A discrete module is used to isolate, convert, and condition discrete signals that pass between the user's device being controlled and the MICRO 84 Programmable Controller. A discrete signal is one that indicates the on or off condition of the device. A discrete input module converts the voltage level received from a control device (pushbutton, limit switch, etc.) to a voltage level that can be used within the programmable controller. Conversely, an output module converts the output voltage from the programmable controller to a voltage level that can be used to control a user device (motor-starter, solenoid valve, etc.).

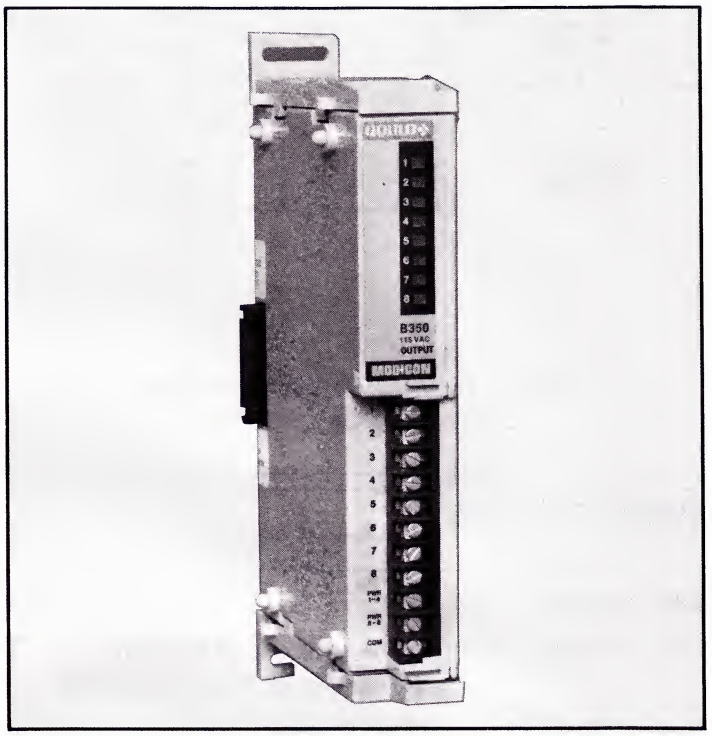
REGISTER MODULES

A register module is used to isolate, convert, and condition binary-coded decimal (BCD) and analog (voltage or current) signals that pass between the user's device being controlled and the MICRO 84 Programmable Controller. A BCD signal is a numeric value in the range of 0-999. A register input module converts the input signals to numeric values usable by the programmable controller. A register output module converts the numeric output of the programmable controller to signals usable by the user's device. Standard hardware to encode and decode BCD numbers is commonly available.

B350-001 / 115 VAC Output Module
DATA SHEET

FEATURES

- Eight independent 115 VAC outputs
- Circuit isolation of 1500 VAC
- Zero-cross switching
- Field side status indicators
- Transient protection
- Surge withstand capability in compliance with IEEE 472-1974 and ANSI C37.90A
- Optional Fanning Strip permits module removal without disturbance to field wiring
- UL and CSA approved
- High 2 Amp current per output
- Designed for harsh plant floor environments



GENERAL DESCRIPTION

The MODICON B350-001, 115 VAC Output Module converts logic signals used within the MODICON MICRO-84 Programmable Controller into 8 independent 115 VAC outputs. Each output is capable of driving relays, pilot lamps, motor starters, solenoids, or other loads up to 2.0 amperes. The module uses 8 triac switches to control loads connected to an external power source. These switches are designed to withstand the high surge currents typical of industrial loads.

Each output is electrically isolated from the controller by an optical coupler. This enables the module and controller to withstand the severe voltage transients prevalent in an industrial environment. The module employs a zero-cross switching technique. This feature minimizes switching noise, extends the life of the triacs, and improves system reliability. Both IEEE and ANSI standards for surge withstand capability (SWC) tests are fully satisfied.

The output circuits are divided into two groups of four outputs each. Each group is driven by a separate voltage source. A neon lamp connected to each circuit's field side displays the ON/OFF status of the output. This lamp indicates the output's true state.

The module is housed in a light weight, durable LEXAN case. A structural "chimney" within the module provides flow-through convection cooling and protection from moisture build-up. Self-contained mounting brackets eliminate the need for special I/O housings. A termination connector shipped with the MICRO-84 mainframe is required when using the module at the extreme right bus location. The module is also compatible with the B351 Input Module without the use of additional components.

User connections are made to a standard screw terminal strip. This strip is compatible with an optional Fanning Strip (P/N 0212-012) which allows quick module replacement without disturbing field wiring. Data bus connections are made with standard interface connectors. These connectors allow the B350 module to be placed in any location in the I/O structure without interference to other module operation.

36

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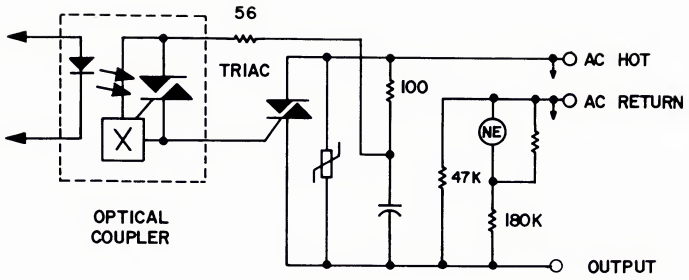
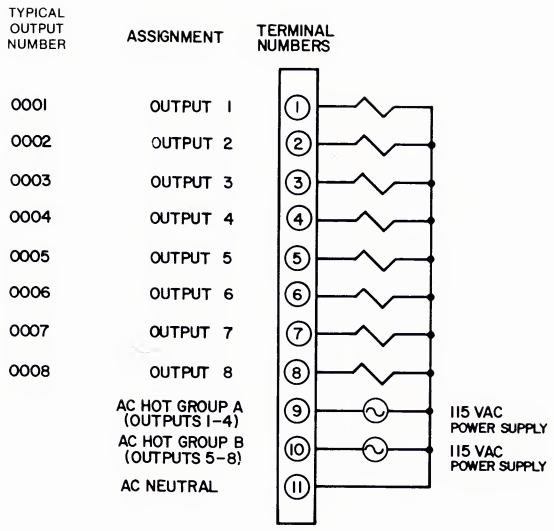


B350 115 VAC Output Module
Simplified Schematic



B350 115 VAC Output Module
Terminal Numbering and Connections

SPECIFICATIONS

Load Ratings

ON Current:	2.0A (max) per output (10.0A max for 8 outputs)
Surge Current:	50A (max) for 1 cycle
Working Voltage:	80 to 130V rms 47 to 63 Hz
Transient Voltage:	200V rms (max) for 1 cycle 150V rms (max) for 10 seconds
ON Voltage Drop:	1.2V at 2A (typical)
OFF Current:	2mA (max)

Circuit Characteristics

Topology:	8 outputs per module 4 outputs per group
Isolation Voltage:	200V rms continuous 1500V rms (peak) for 60 sec.
Response Time:	ON to OFF, 8.3 msec OFF to ON, 8.3 msec
Surge Withstand Capability:	Per IEEE 472-1974 and ANSI C37.90A (2500V decaying in 6 microsec.)

Physical Characteristics

Environment:

Temperature	0 to 60°C (ambient)
Humidity	0 to 95% (non-condensing)
Shock	10 G for 11 msec.
Vibration	.625 G, 50-500 Hz
EMI	Per MIL-STD 461B
RFI	Per FCC Class A

Dimensions:	1.62 in. (41.8 mm) X 6.00 in. (152.4 mm) X 11.00 in. (279.4 mm)
Weight:	2.0 lbs. (.91 kg)

CAUTION

During the power-up sequence, AC output modules may cause the false triggering of certain loads for one-half cycle. The loads most susceptible are latching relays, fast-acting solenoids, and latching circuits.

Special circuit designs have been incorporated to minimize this false triggering. However, applications using fast reacting or latching devices that initiate mechanical action may be a hazzard.

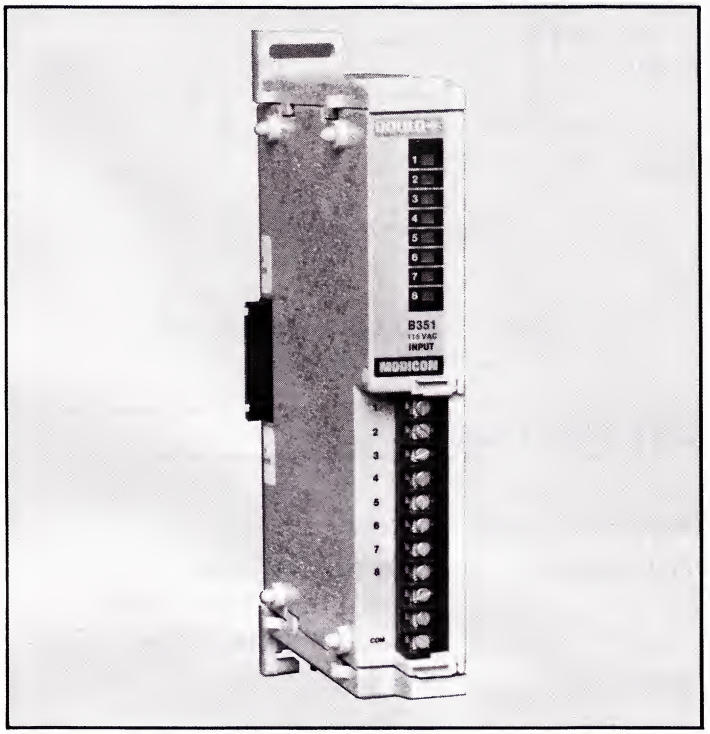
Gould Inc., Modicon Programmable Control Division
P.O. Box 83 S.V.S. Andover, Mass. 01810
Telephone (617) 475-4700
40108 5M 1182NP Printed in U.S.A.

GOULD
Electronics & Electrical Products

B351-001 / 115 VAC Input Module
DATA SHEET

FEATURES

- Eight independent 115 VAC inputs
- Circuit isolation of 1500 VAC
- Field side status indicators
- Transient protection
- Surge withstand capability in compliance with IEEE 472-1974 and ANSI C37.90A
- Optional Fanning Strip permits module removal without disturbance to field wiring
- UL and CSA approved
- Designed for harsh plant floor environments



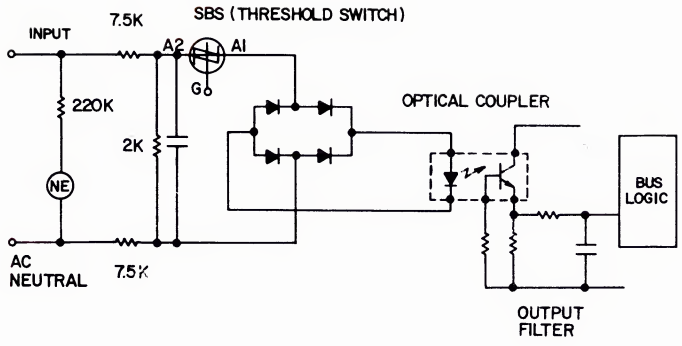
GENERAL DESCRIPTION

The MODICON B351-001, 115 VAC Input Module senses and converts switched input signals into logic voltage levels used by MODICON's MICRO-84 Controller. The module allows for up to eight independently sensed inputs. Inputs can be received from push buttons, limit and proximity switches, temperature and pressure switches, as well as other 115V sources. Eight independent threshold switches sense inputs from an external power source.

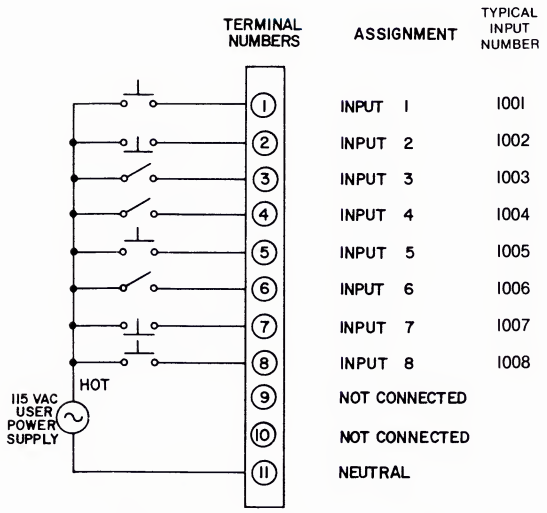
Each input is electrically isolated by an optical coupler. A neon lamp connected to the circuit's field side displays the ON/OFF status of the input. The lamp indicates the input's true state. Both IEEE and ANSI standards for surge withstand capability (SWC) tests are fully satisfied. The module is designed to withstand the severe voltage transients prevalent in industrial environments.

The B351 Input Module is housed in a light weight, durable LEXAN case. A structural "chimney" within the module provides flow-through convection cooling and protection from moisture build-up. Self-contained mounting brackets eliminate the need for special I/O housings. A termination connector shipped with the MICRO-84 mainframe is required when using the module at the extreme right bus location.

User connections are made to a standard screw terminal strip. This strip is compatible with an optional Fanning Strip (P/N 0212-012) allowing quick module replacement without disturbing field wiring. Data bus connections are made with standard interface connectors. These connectors allow the B351 Input Module to be placed in any location in the I/O structure without interference to other module operation.



B351 115 VAC Input Module
Simplified Schematic



B351 115 VAC Input Module
Terminal Numbering and Connections

SPECIFICATIONS

Electrical Characteristics

ON Level:	80 to 130V rms (less than 1000 ohms source impedance)
OFF Level:	0 to 45V rms (less than 1000 ohms source impedance) 0 to 130V rms (greater than 80K ohms source impedance)
Input Wetting Current:	5mA (typical) @ 80V rms input
Source Resistance:	1000 ohm (max)
Threshold Voltage:	45 to 80V rms
Max Input Voltage:	130V rms continuous
Frequency:	47 to 63 Hz

Circuit Characteristics

Topology:	8 inputs per module
Isolation Voltage:	1500V rms for 60 sec.
Response Time:	ON to OFF, 30 ms (max) OFF to ON, 10 ms (max)
Visual Indicators:	One neon lamp per input ON when input is ON
Surge Withstand Capability:	Per IEEE 472-1974 and ANSI C37.90A (2500V decaying in 6 microsec.)

Physical Characteristics

Environment:

Temperature	0 to 60°C (ambient)
Humidity	0 to 95% (non-condensing)
Shock	10 G for 11 msec.
Vibration	.625 G, 50-500 Hz
EMI	Per MIL-STD 461B
RFI	Per FCC Class A

Dimensions:	1.62 in. (41.8 mm) X 6.00 in. (152.4 mm) X 11.00 in. (279.4 mm)
Weight:	2.0 lbs. (.91 kg)

NOTES

The B351-001 Input Module is compatible with the B350-001 Output Module without the use of additional components.

Gould Inc., Modicon Programmable Control Division
P.O. Box 83 S.V.S. Andover, Mass. 01810
Telephone (617) 475-4700
40108 5M 1182NP Printed in U.S.A.

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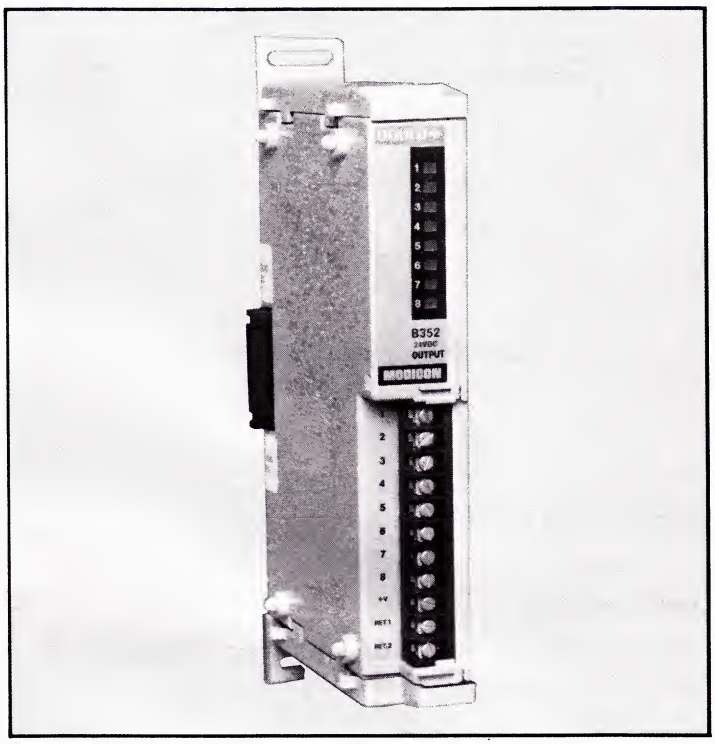
B352-001 / 24 VDC Output Module (True Low)
DATA SHEET

FEATURES

- Eight independent 24 VDC outputs
- Circuit isolation of 1500 VDC
- Field side status indicators
- Transient protection
- Surge withstand capability in compliance with IEEE 472-1974 and ANSI C37.90A
- Optional Fanning Strip permits module removal without disturbance to field wiring
- UL and CSA approved
- High 2 amp current per output
- Designed for harsh plant floor environments



GENERAL DESCRIPTION

The MODICON B352-001, 24 VDC Output Module converts logic signals used within the MODICON MICRO-84 Programmable Controller into 8 independent 24 VDC outputs. Logic format for the module is "true low". Each output is capable of driving relays, pilot lamps, motor starters, solenoids, and other loads up to 2.0 amperes. The module uses 8 transistor switches to control loads connected to an external power source. These switches are designed to withstand the high surge currents typical of industrial loads.

Each output is electrically isolated from the controller by an optical coupler. This enables the module and controller to withstand the severe voltage transients prevalent in an industrial environment. Both IEEE and ANSI standards for surge withstand capability (SWC) tests are fully satisfied.

The output circuits are divided into two groups of four outputs each. Each group is driven by a separate voltage source. An LED indicator connected to each circuit's field side displays the ON/OFF status of the output. The LED indicates the output's true state.

The module is housed in a light weight, durable LEXAN case. A structural "chimney" within the module provides flow-through convection cooling and protection from moisture build-up. Self-contained mounting brackets eliminate the need for special I/O housings. A termination connector is shipped with the MICRO-84 mainframe to be used when the module is attached at the extreme right bus location.

User connections are made to a standard screw terminal strip. This strip is compatible with an optional Fanning Strip (P/N 0212-012) which allows quick module replacement without disturbing field wiring. Data bus connections are made with standard interface connectors. These connectors allow the B352 Output Module to be placed in any location in the I/O structure without interference to other module operation.

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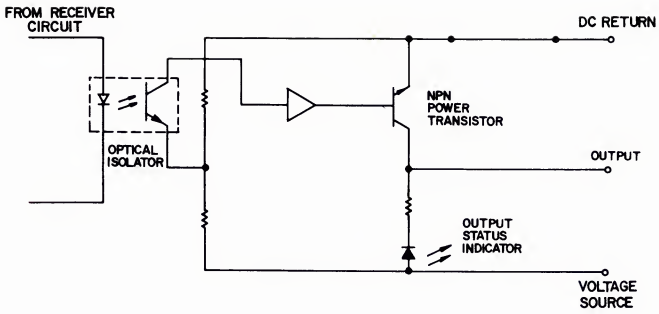
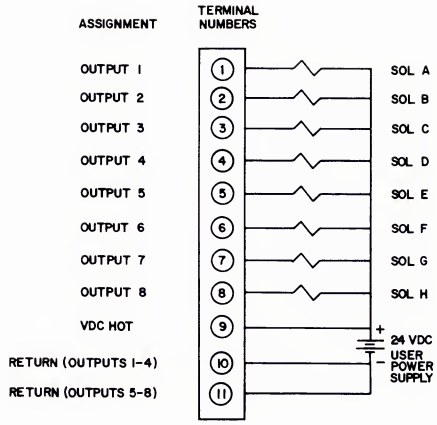


B352-001 Output Module
Simplified Schematic



B352-001 Output Module
Terminal Numbering and Connections

SPECIFICATIONS

Load Ratings

ON Current:	2.0A (max) continuous per output (10.0A max per module)
Surge Current:	5A (max) for 10 msec
Working Voltage:	18 to 30 VDC
Transient Voltage:	50 VDC for 10 ms
ON Voltage Drop:	1.2V at 2A
OFF Current:	1mA (max)

Circuit Characteristics

Topology:	8 outputs per module
Isolation Voltage:	300 VAC continuous 1500 VDC (peak) for 10 sec.
Response Time:	ON to OFF, 1 msec OFF to ON, 1 msec
Visual Indicators:	One LED per input ON when input is ON (low)
Surge Withstand Capability:	Per IEEE 472-1974 and ANSI C37.90A (2500V decaying in 6 microsec.)

Physical Characteristics

Environment:

Temperature	0 to 60°C (ambient)
Humidity	0 to 95% (non-condensing)
Shock	10 G for 11 msec.
Vibration	.625 G, 50-500 Hz
EMI	Per MIL-STD 461B
RFI	Per FCC Class A

Dimensions:	1.62 in. (41.8 mm) X 6.00 in. (152.4 mm) X 11.00 in. (279.4 mm)
Weight:	2.0 lbs. (.91 kg)

NOTES

The B352-001 Output Module is compatible with the MODICON B353-001 Input Module without the use of additional components.

Gould Inc., Modicon Programmable Control Division
P.O. Box 83 S.V.S. Andover, Mass. 01810
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40108 5M 1182NP Printed in U.S.A.

GOULD
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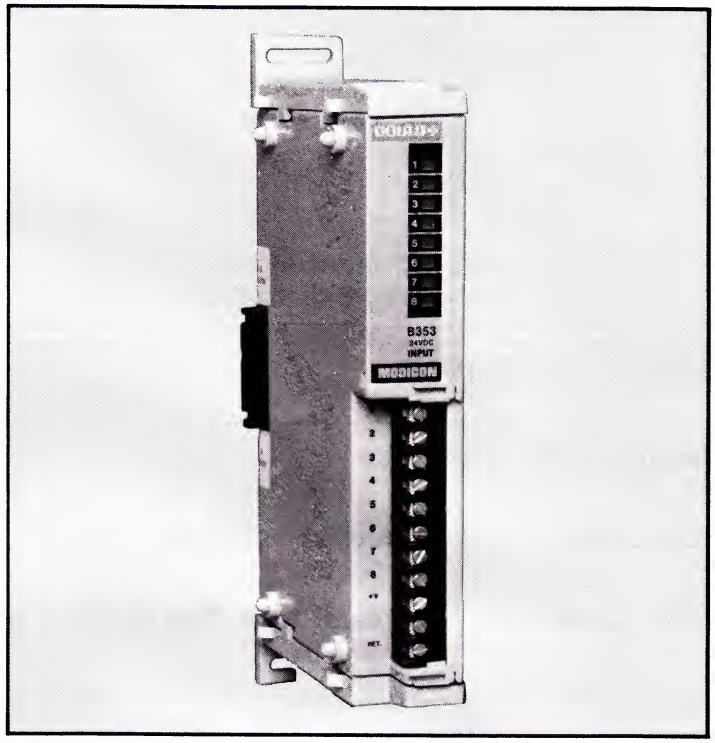
B353-001 / 24 VDC Input Module (True Low)
DATA SHEET

FEATURES

- Eight independent 24 VDC inputs
- Circuit isolation of 1500 VDC
- Field side status indicators
- Transient protection
- Surge withstand capability in compliance with IEEE 472-1974 and ANSI C37.90A
- Optional Fanning Strip permits module removal without disturbance to field wiring
- UL and CSA approved
- Designed for harsh plant floor environments



GENERAL DESCRIPTION

The MODICON B353-001, 24 VDC Input Module senses and converts switched input signals into logic voltage levels used by MODICON's MICRO-84 Controller. The logic format for the module is "true low". Inputs can be received from push buttons, limit and proximity switches, temperature and pressure switches, as well as other 24V sources. Eight independent threshold switches sense inputs from an external power source.

Each input is electrically isolated by an optical coupler. An LED indicator connected to the circuit's field side displays the true ON/OFF status of the input. Both IEEE and ANSI standards for surge withstand capability (SWC) tests are fully satisfied. This enables the module and controller to withstand severe voltage transients prevalent in industrial environments.

The module is housed in a light weight, durable LEXAN® case. A structural "chimney" within the module provides flow-through convection cooling and protection from moisture build-up. Self-contained mounting brackets eliminate the need for special I/O housings. A termination connector is shipped with the MICRO-84 mainframe to be used when the module is attached at the extreme right bus location.

User connections are made to a standard screw terminal strip. This strip is compatible with an optional Fanning Strip (P/N 0212-012) allowing quick module replacement without disturbing field wiring. Data bus connections are made with standard interface connectors. These connectors allow the B353 Input Module to be placed in any location in the I/O structure without interference to other module operation.

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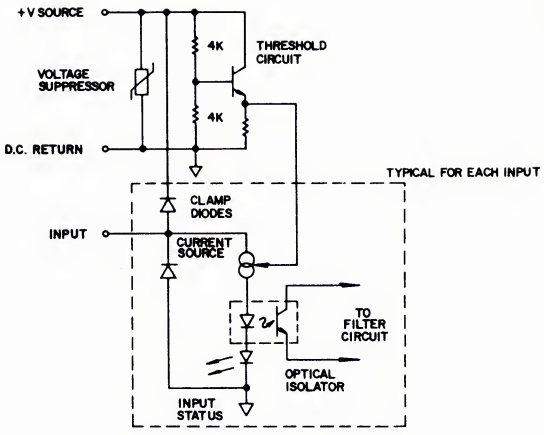
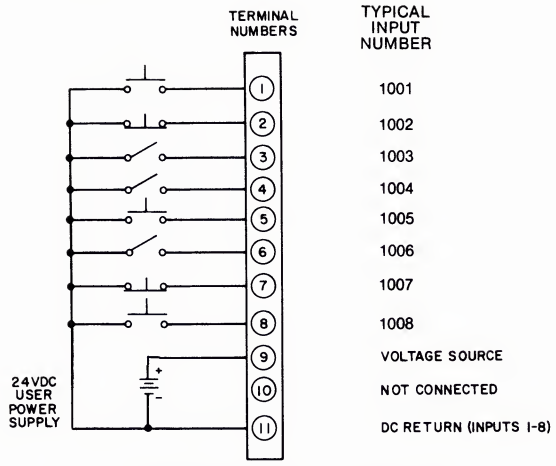


B353-001 Input Module
Simplified Schematic



B353-001 Input Module
Terminal Numbering and Connections

SPECIFICATIONS

Electrical Characteristics

ON Level:	Less than 30% of V source
OFF Level:	Greater than 70% of V source
Source Resistance:	1000 ohm (max) at 10 VDC
Threshold Voltage:	30-70% of V source
Max Input Voltage:	50 VDC, 10 ms

Circuit Characteristics

Topology:	8 inputs per module, true low
Isolation Voltage:	300 VAC continuous 1500 VDC for 100 msec
Response Time:	ON to OFF, 12 ms (max) OFF to ON, 12 ms (max)
Visual Indicators:	One LED indicator per input ON when input is ON (low)
External Power Supply:	24 VDC at 100 mA (max)
Surge Withstand Capability:	Per IEEE 472-1974 and ANSI C37.90A (2500V decaying in 6 microsec.)

Physical Characteristics

Environment:

Temperature	0 to 60°C (ambient)
Humidity	0 to 95% (non-condensing)
Shock	10 G for 11 msec.
Vibration	.625 G, 50-500 Hz
EMI	Per MIL-STD 461B
RFI	Per FCC Class A

Dimensions:	1.62 in. (41.8 mm) X 6.00 in. (152.4 mm) X 11.00 in. (279.4 mm)
Weight:	2.0 lbs. (.91 kg)

NOTES

The B353-001 Input Module is compatible with the MODICON B352-001 Output Module without the use of additional components.

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B353-001 Lit. No. 40108 Printed in USA 0783

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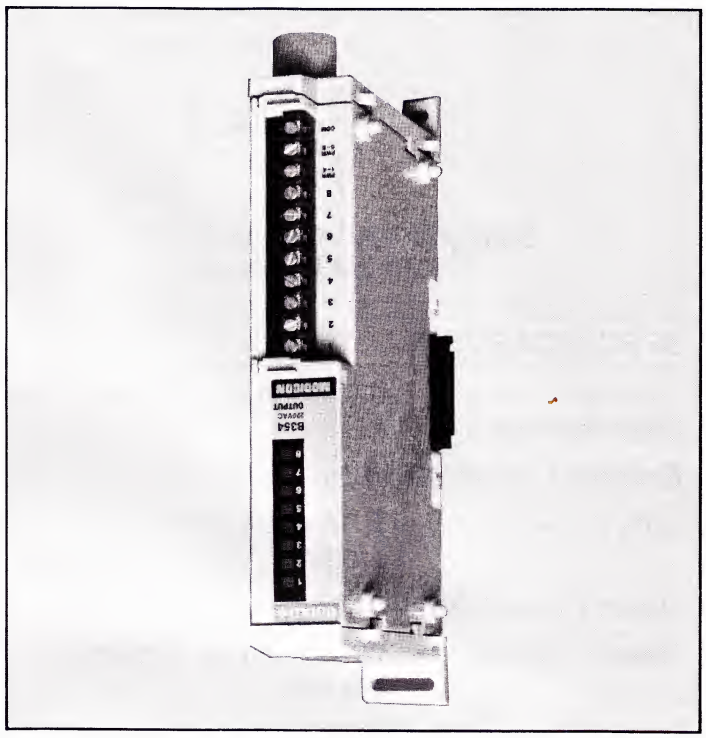
B354-001 / 220 VAC Output Module
DATA SHEET

FEATURES

- Eight independent 220 VAC outputs
- Circuit isolation of 1500 VAC
- Field side status indicators
- Transient protection
- Surge withstand capability in compliance with IEEE 472-1974 and ANSI C37.90A
- Optional Fanning Strip permits module removal without disturbance to field wiring
- UL and CSA approved
- High current per output (2 Amp)
- Designed for harsh plant floor environments



GENERAL DESCRIPTION

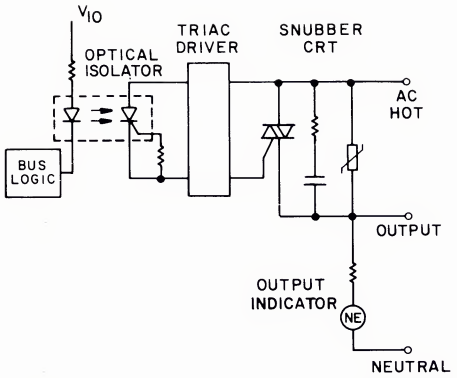
The Modicon B354-001, 220 VAC Output Module converts logic signals used within the Modicon Micro-84 Programmable Controller into 8 independent 220 VAC outputs. Each output is capable of loads up to 2.0 amperes. The module uses 8 triac switches to control loads connected to an external power source. These switches are designed to withstand the high surge currents typical of industrial loads.

Each output is electrically isolated from the controller by an optical coupler. This enables the module and controller to withstand the severe voltage transients prevalent in an industrial environment. Both IEEE and ANSI standards for surge withstand capability (SWC) tests are fully satisfied.

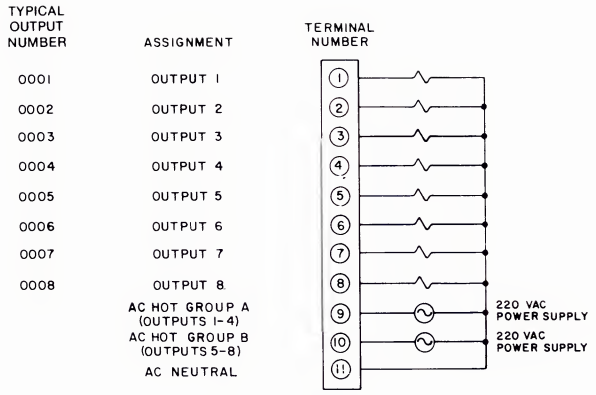
The output circuits are divided into two groups of four outputs each. Each group is driven by a separate voltage source. A neon lamp connected to each circuit's field side displays the ON/OFF status of the output. The lamp indicates the output's true state.

The module is housed in a light weight, durable LEXAN case. A structural chimney within the module provides flow-through convection cooling and protection from moisture build-up. Self-contained mounting brackets eliminate the need for special I/O housings. A termination connecter shipped with the Micro-84 is required when using the module at the extreme right bus location. The module is also compatible with the B355 Input Module without the use of additional components.

User connections are made to a standard screw terminal strip. The strip is compatible with an optional Fanning Strip (P/N 0212-012) which allows quick module replacement without disturbing field wiring. Data bus connections are made with standard interface connectors. These connectors allow the B354 module to be placed in any location in the I/O structure without interference to other module operation.



B354 220 VAC Output Module
Simplified Schematic



B354 220 VAC Output Module
Terminal Numbering and Connections

SPECIFICATIONS

Load Ratings

Electrical Characteristics

ON Current:	2.0A (max) per output (10.0A max for 8 outputs)
Load Current (Min):	50 mA
Surge Current:	50A (max) for 1 cycle (60 Hz)
Working Voltage:	180 to 260V rms 47 to 63 Hz
Transient Voltage:	300V rms (max) for 10 sec. 400V rms (max) for 1 cycle
ON Voltage Drop:	1.2V rms at 2A (typical)
OFF Current:	5 mA (max)

Circuit Characteristics

Topology:	8 outputs per module 4 outputs per group
Isolation Voltage:	400V rms continuous 1500V rms peak for 60 sec.
Response Time:	ON to OFF, 8.3 msec.(max) OFF to ON, 1 msec. (max)
Surge Withstand Capability:	Per IEEE 472-1974 and ANSI C37.90A (2500V decaying in 6 microsec at 1.5 mHz)

Physical Characteristics

Environment:	
Temperature	0 to 60°C (ambient)
Humidity	0 to 95% (non-condensing)
Shock	10 G for 11 msec.
Vibration	.625 G, 50-500 Hz
EMI	Per MIL-STD 461B
RFI	Per FCC Class A
Dimensions:	1.62 in. (41.8 mm) X 6.00 in. (152.4 mm) X 11.00 in. (279.4 mm)
Weight:	2.0 lbs. (.91 kg)

CAUTION

During the power-up sequence, AC output modules may cause the false triggering of certain loads for one half cycle. The loads most susceptible are latching relays, fast-acting solenoids, and latching circuits.

Special circuit designs have been incorporated to minimize this false triggering. However, applications using fast reacting or latching devices that initiate mechanical action may be a hazard.

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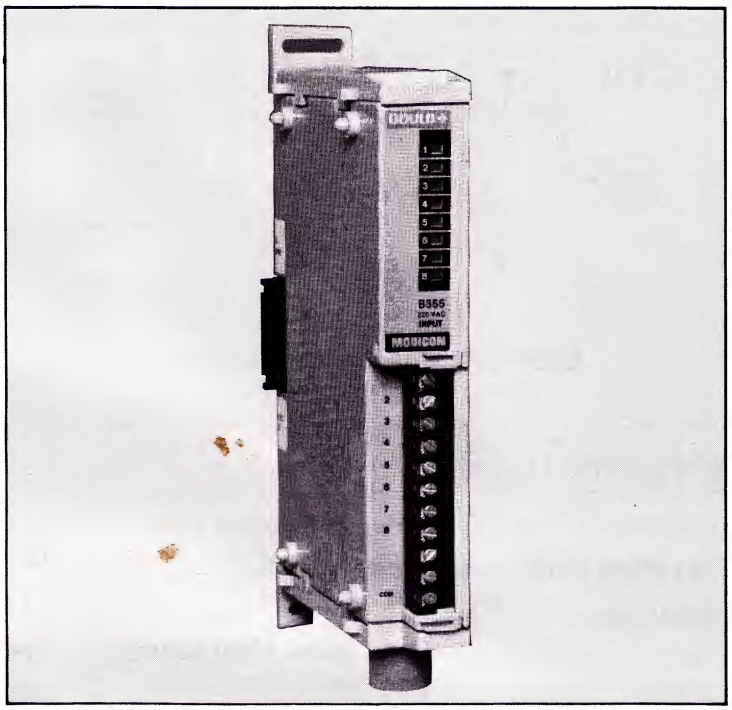
B355-001 / 220 VAC Input Module
DATA SHEET

FEATURES

- Eight independent 220 VAC inputs
- Circuit isolation of 1500 VAC
- Field side status indicators
- Transient protection
- Surge withstand capability in compliance with IEEE 472-1974 and ANSI C37.90A
- Optional Fanning Strip permits module removal without disturbance to field wiring
- UL and CSA approved
- Designed for harsh plant floor environments



GENERAL DESCRIPTION

The Modicon B355-001, 220 VAC Input Module senses and converts switched input signals into logic voltage levels used by Modicon's Micro-84 Controller. The module allows for up to eight independently sensed inputs. Eight independent threshold switches sense inputs from an external power source. Inputs can be received from push buttons, limit and proximity switches, temperature and pressure switches, as well as other 220V sources.

Each input is electrically isolated by an optical coupler. A neon lamp connected to the circuit's field side displays the ON/OFF status of the input. The lamp indicates the input's true state. Both IEEE and ANSI standards for surge withstand capability (SWC) tests are fully satisfied. The module is designed to withstand the severe voltage transients prevalent in industrial environments.

The B355 Input Module is housed in a light weight, durable LEXAN case. A structural chimney within the module provides flow-through convection cooling and protection from moisture build-up. Self-contained mounting brackets eliminate the need for special I/O housings. A termination connector shipped with the Micro-84 is required when using the module at the extreme right bus location.

User connections are made to a standard screw terminal strip. This strip is compatible with an optional Fanning Strip (P/N 0212-012) allowing quick module replacement without disturbing field wiring. Data bus connections are made with standard interface connectors. These connectors allow the B355 Input Module to be placed in any location in the I/O structure without interference to other module operation.

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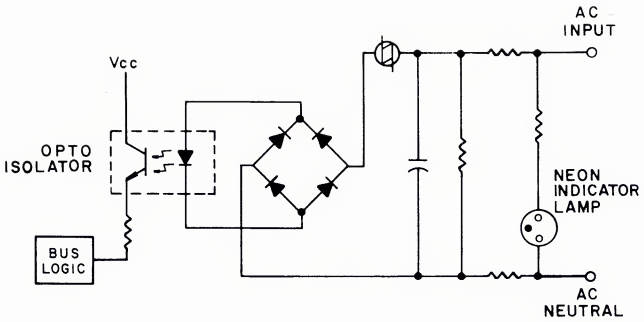
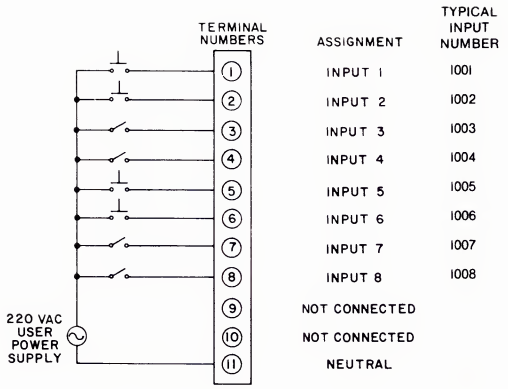


B355 220 VAC Input Module
Simplified Schematic



B355 220 VAC Input Module
Terminal Numbering and Connections

SPECIFICATIONS

Electrical Characteristics

ON Level:	180 to 260V rms (less than 1000 ohms source impedance)
OFF Level:	0 to 90V rms (less than 1000 ohms source impedance) 0-260V rms (greater than 80K ohms source impedance)
Input Wetting Current:	5 mA (typical) @ 180 to 260V rms input
Source Resistance:	1000 ohm (max)
Threshold Voltage:	125V rms (approx.)
Max Input Voltage:	260V rms continuous 300V rms 10 sec. 400V rms 1 cycle
Frequency:	47 to 63 Hz

Circuit Characteristics

Topology:	8 inputs per module
Isolation Voltage:	1500V rms for 60 sec
Response Time:	ON to OFF, 26 ms (max) OFF to ON, 14 ms (max)
Visual Indicators:	One neon lamp per input ON when input is ON
Surge Withstand Capability:	Per IEEE 472-1974 and ANSI C37.90A (2500V decaying in 6 microsec)

Physical Characteristics

Environment:

Temperature	0 to 60°C (ambient)
Humidity	0 to 95% (non-condensing)
Shock	10 G for 11 msec
Vibration	.625 G, 50-500 Hz
EMI	Per MIL-STD 461B
RFI	Per FCC Class A

Dimensions:	1.5 in. (42 mm) X 6.00 in. (152 mm) X 11.00 in. (279 mm)
Weight:	2.0 lbs. (.91 kg)

NOTES

The B355-001 Input Module is compatible with the B354-001 Output Module without the use of additional components. If a direct connection exists, a 50 mA loading resistor is required to guarantee the output module's 50 mA minimum load current.

Gould Inc., Modicon Programmable Control Division
P.O. Box 83 S.V.S. Andover, Mass. 01810
Telephone (617) 475-4700

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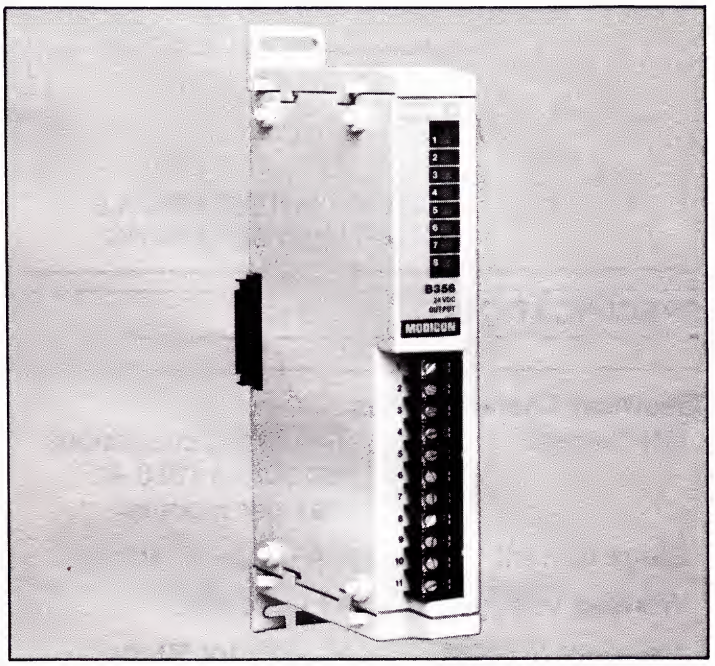
B356-001 / 24 VDC Output Module (True High)
DATA SHEET

The B356-001, 24 VDC Output Module (True High) converts logic signals used within the *Micro 84*™ Controller into eight, independent 24 VDC outputs.

FEATURES

- Eight independent 24 VDC outputs
- Circuit isolation of 1500 VAC
- Field side status indicators
- Transient protection
- Surge withstand capability in compliance with IEEE 472-1974 and ANSI C37.90A
- Optional Fanning Strip permits module removal without disturbing field wiring
- Designed to meet UL and CSA standards
- High 2 Amp current per output
- Designed for harsh plant floor environments



GENERAL DESCRIPTION

The Modicon B356-001, 24 VDC Output Module converts logic signals used within the Modicon *Micro 84*™ Programmable Controller into eight independent 24 VDC outputs. Logic format for the module is "true high". Each output is capable of driving relays, pilot lamps, motor starters, solenoids, or other loads up to 2.0 Amperes. The module uses eight transistor switches to control loads connected to an external power source. These switches are designed to withstand the high surge currents typical of industrial loads.

Each output is electrically isolated from the controller by an optical coupler. This enables the module and controller to withstand the severe voltage transients prevalent in an industrial environment. Both IEEE and ANSI standards for surge withstand capability (SWC) tests are fully satisfied.

The output circuits are divided into two groups of four outputs each. Each group is driven by a separate voltage source. An LED indicator connected to each circuit's field side displays the ON/OFF status of the output. The LED indicates the output's true state.

The module is housed in a light weight, durable LEXAN case. A structural "chimney" within the module provides flow-through convection cooling and protection from moisture build-up. Self-contained mounting brackets eliminate the need for special I/O housings. A termination connector is shipped with the *Micro 84* mainframe to be used when the module is attached to the extreme right bus location.

User connections are made to a standard screw terminal strip. This strip is compatible with an optional Fanning Strip (P/N 0212-012) which allows quick module replacement without disturbing field wiring. Data bus connections are made with standard interface connectors. These connectors allow the B356 Output Module to be placed in any location in the I/O structure without interfering with other module operations.

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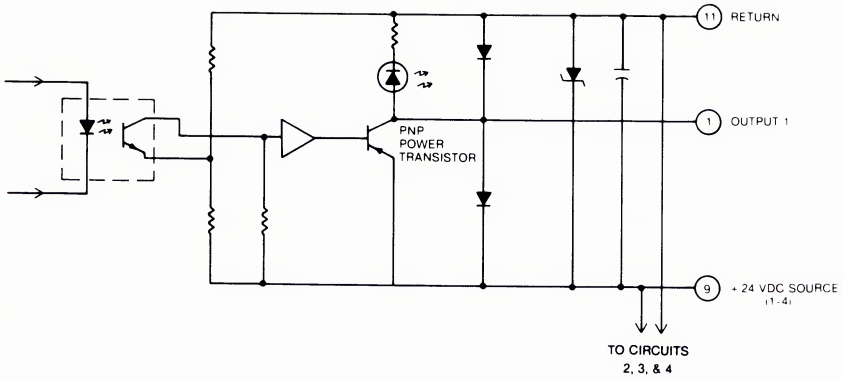
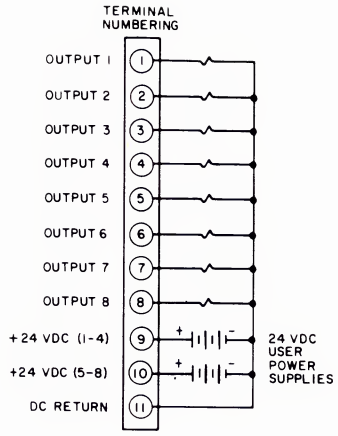


B356-001 OUTPUT MODULE
SIMPLIFIED SCHEMATIC



B356-001 OUTPUT MODULE TERMINAL
NUMBERING AND CONNECTIONS

SPECIFICATIONS

Electrical Characteristics

ON Current	2.0A (max) continuous per output (10.0 A max per module)
Surge Current	5 A (max) for 10 ms
Working Voltage	18 to 30 VDC
Transient Voltage	50 VDC for 10 ms
ON Voltage Drop	1.2 V at 2 A
OFF Load Current	1 mA (max)

Module Characteristics

Topology	8 outputs per module
Isolation Voltage	300 VAC continuous 1500 VDC (peak) for 100 ms
Response Time	ON to OFF, 1 ms OFF to ON, 1 ms
Visual Indicators	One LED per input ON when input is ON (high)
Surge Withstand Capability	Per IEEE 472-1974 and ANSI C37.90A (2500V decaying in 6 μs)

Environment

Temperature	0 to 60°C (ambient)
Humidity	0 to 95°C (non-condensing)
Shock	10 G for 11 ms
Vibration	0.625 G, 50-500 Hz
EMI	Per MIL-STD 461B
RFI	Per FCC Class A
Dimensions (W x H x D)	1.62 in x 6.00 in x 11.00 in (41.8 mm x 152.4 mm x 279.4 mm)
Weight	2.0 lbs (0.91 kg)

NOTES

The B356-001 Output Module is compatible with the Modicon B353-001 Input Module without the use of additional components.

Gould Inc., Programmable Control Division
P.O. Box 3083, Andover, Mass. 01810
(617) 475-4700 - Telex 94-7402

15M-10/83 Printed in U.S.A.

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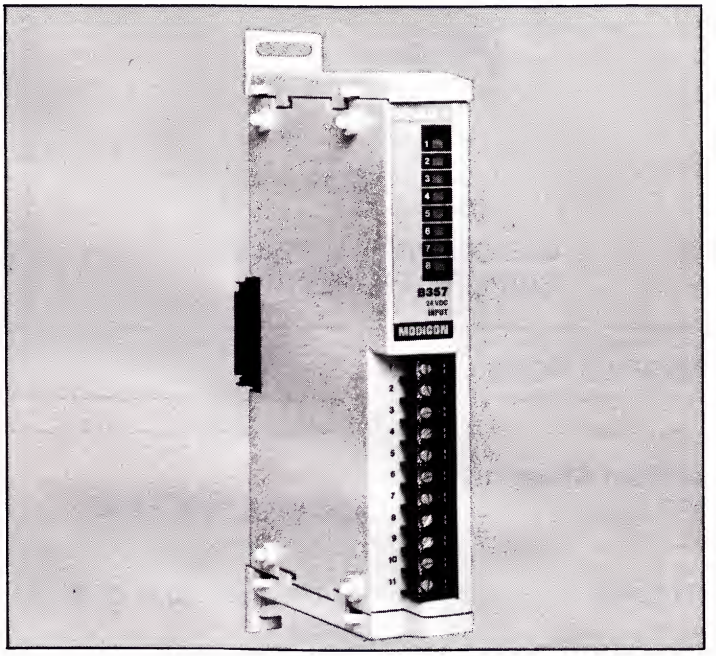
Electronics

B357-001 / 24 VDC Input Module (True High)
DATA SHEET

The B357-001, 24 VDC Input Module senses and converts 24 VDC switched input signals into logic voltage levels used by the *Micro 84*™ Controller.

FEATURES

- Eight independent 24 VDC inputs
- Circuit isolation of 1500 VAC
- Field side status indicators
- Transient Protection
- Surge withstand capability in compliance with IEEE 472-1974/ANSI C37.90A
- Optional Fanning Strip permits module removal without disturbing field wiring
- Designed to meet UL and CSA standards
- Designed for harsh plant floor environments



GENERAL DESCRIPTION

The Modicon B357-001, 24 VDC Input Module senses and converts switched input signals into logic voltage levels used by Modicon's *Micro 84*™ Controller. The logic format for the module is "true high". Inputs can be received from push buttons, limit and proximity switches, temperature and pressure switches, as well as other 24 VDC sources. Eight independent threshold switches sense inputs from an external power source.

Each input is electrically isolated by an optical coupler. An LED indicator connected to the circuit's field side displays the true ON/OFF state of the input. Both the IEEE and ANSI standards for surge withstand capability (SWC) tests are fully satisfied. This enables the module and controller to withstand severe voltage transients prevalent in industrial environments.

The module is housed in a light weight, durable LEXAN case. A structural "chimney" within the module provides flow-through convection cooling and protection from moisture build-up. Self-contained mounting brackets eliminate the need for special I/O housings. A termination connector is shipped with the *Micro 84* mainframe to be used when the module is attached to the extreme right bus location.

User connections are made to a standard screw terminal strip. This strip is compatible with an optional Fanning Strip (P/N 0212-012) which allows quick module replacement without disturbing field wiring. Data bus connections are made with standard interface connectors. These connectors allow the B357 Input Module to be placed in any location in the I/O structure without interfering with other module operation.

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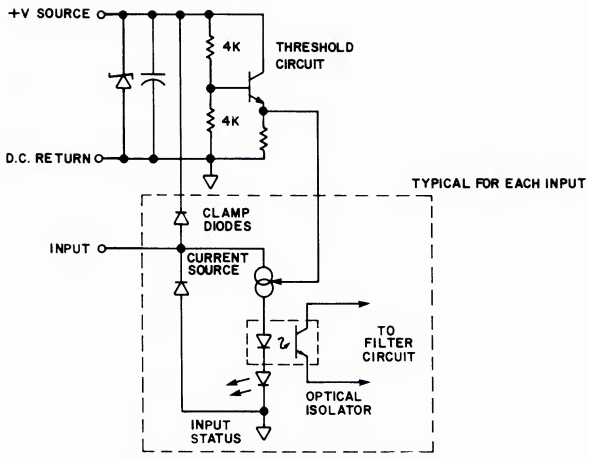
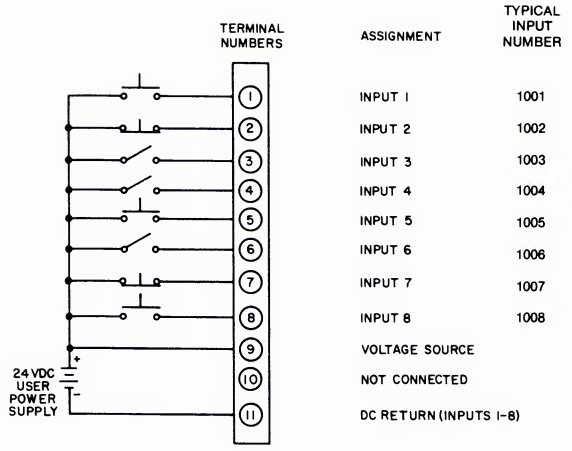


B357-001 INPUT MODULE
SIMPLIFIED SCHEMATIC



B357-001 INPUT MODULE
TERMINAL NUMBERING AND CONNECTIONS

SPECIFICATIONS

Electrical Characteristics

OFF Level	Less than 30% of V source
ON Level	Greater than 70% of V source
Source Resistance	1000 ohm (max) at 10 VDC
Threshold Voltage	30-70% of V source
Max Input Voltage	50 VDC, 10 ms
V Source Range	18 to 30 VDC

Module Characteristics

Topology	8 inputs per module, true high
Isolation Voltage	300 VAC continuous 1500 VDC for 100 ms
Response Time	ON to OFF, 12 ms (max) OFF to ON, 12 ms (max)
Visual Indicators	One LED indicator per input ON when input is ON (high)
External Power Supply	24 VDC at 100 mA (max)
Surge Withstand Capability	Per IEEE 472-1974 and ANSI C37.90A (2500V decaying in 6 μs)

Physical Characteristics

Environment

Temperature	0 to 60°C (ambient)
Humidity	0 to 95% (non-condensing)
Shock	10 G for 11 ms
Vibration	0.625 G, 50-500 Hz
EMI	Per MIL-STD 461B
RFI	Per FCC Class A
Dimensions (W x H x D)	1.62 in x 6.00 in. x 11.00 in (41.8 mm x 152.4 mm x 279.4 mm)
Weight	2.0 lbs (0.91 kg)

NOTES

The B357-001 Input Module is compatible with the Modicon B356-001 Output Module without the use of additional components.

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15M-10/83 Printed in U.S.A.

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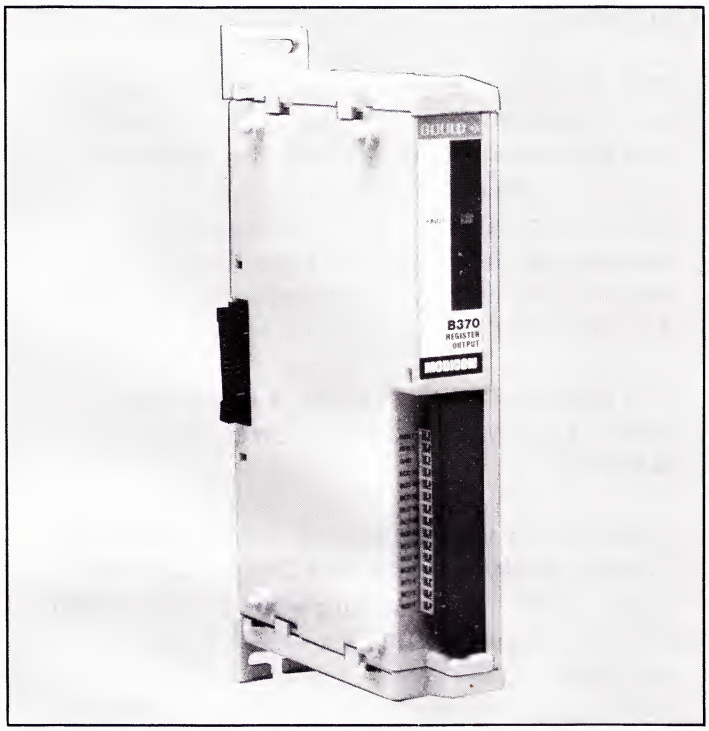
B370-001 BCD Register Output Module DATA SHEET

The B370-001 receives binary data from the *Micro 84*™ controller and converts it to a BCD output. It applies this output to any TTL/CMOS device such as an LED or LCD display.

FEATURES

- Generates two, 3-digit channels
- Popular true high BCD format
- TTL and CMOS compatible
- 12-bit BCD resolution
- Self-contained power supply
- Short-circuit proof
- Continuous on-line diagnostics
- Removable wiring strip
- Designed for harsh industrial environments
- Designed to meet UL and CSA standards



GENERAL DESCRIPTION

The B370-001 BCD Register is a dual channel output module for the *Micro 84* Controller. It receives data from two output registers in the controller at the end of every scan. It converts the data into a 12-bit binary coded decimal (BCD) signal. This value ranges from 000 to 999. BCD outputs are directly proportional to output register data.

Typically the B370 is used in applications to interface timer, counter, sequencer, or other register numerical data with BCD controlled field devices. It is also used with displays on operator control panels. Most TTL or CMOS compatible, latched, BCD displays will directly interface with the B370 without the use of additional components. Similarly, it can drive BCD field devices such as valves, positioners, temperature controllers, monitors, or other BCD transducers.

The B370 receives numerical data from output registers 4010, 4012, 4014, and 4016 from both 1K and 2K *Micro 84* controllers, and output registers 4018, 4020, 4022, and 4024 in the 2K controller. Since there are two BCD channels per module, the 1K controller supports up to two B370 modules. The 2K controller supports up to four B370 modules. Similar to the discrete output modules, the first register output module interfaces the first output registers (4010 and 4012), and each successive module interfaces successive output registers.

The B370 is organized in a channel strobe architecture: There are 12 data lines and two strobe lines. The data lines are shared by both receiving devices. The strobe lines select which device is to receive data. Both channels are strobed on each scan of the *Micro 84*. The format of the output data (BCD 1 through BCD 800) is true high (positive). The output data is valid only when the strobe is true low (negative).

The B370 BCD Register Output Module is easy to install. It is housed in a light-

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weight, durable, drip-proof lexan case. It contains mounting brackets which simplify installation. It can be mounted anywhere in the I/O structure. Connectors located on the left- and right-rear sides of the case plug into similar connectors on adjacent modules.

This plugging action automatically connects the B370 to the data bus of the *Micro 84* Controller. If the B370 is the right-most module in the I/O structure, plug a termination connector into the connector located on the right-rear side. This termination connector is shipped with the *Micro 84* Controller.

The B370 does not require a separate power supply. It receives power from the *Micro 84*.

Field wiring is also easy to install. (See the "Terminal Numbering and Output Connections" diagram for wiring your B370 to field devices.) You can use shielded or unshielded wires having a size of 14 to 22 AWG. Just terminate the wires to a removable, 15-screw terminal male plug, which is mounted on the front of the B370. This plug is easily removed, which allows you to quickly replace the B370 without disturbing field wiring.

Besides the connector with its removable plug, a FAULT indicator is also located on the B370's front panel. This indicator is a troubleshooting aid. It turns on whenever the internal diagnostic tests detect a failure. These tests continuously exercise random access memory (RAM), read only memory (ROM), and communications circuitry.

The RAM and ROM tests are performed when the B370 is first powered up and are performed continuously during operation. Every data and strobe transfer to the field wiring is verified by diagnostic tests for integrity. Potential errors are immediately corrected. For safety, three consecutive diagnostic errors will automatically shut down system scanning (approx. 15 ms.).

In addition to the FAULT indicator, the B370 is protected against both over voltages and high current. The B370 is able to withstand the accidental application of 0 to +24 VDC on any data or strobe output. Each output has current limited, short circuit protection.

The B370-001 BCD Register Output Module meets the stringent requirements of both IEEE and ANSI standards for radiated surge withstand capability (SWC). The module also withstands the severe voltage transients, electromagnetic interference, and magnetic fields commonly encountered in an industrial environment.

SPECIFICATIONS

Electrical Characteristics

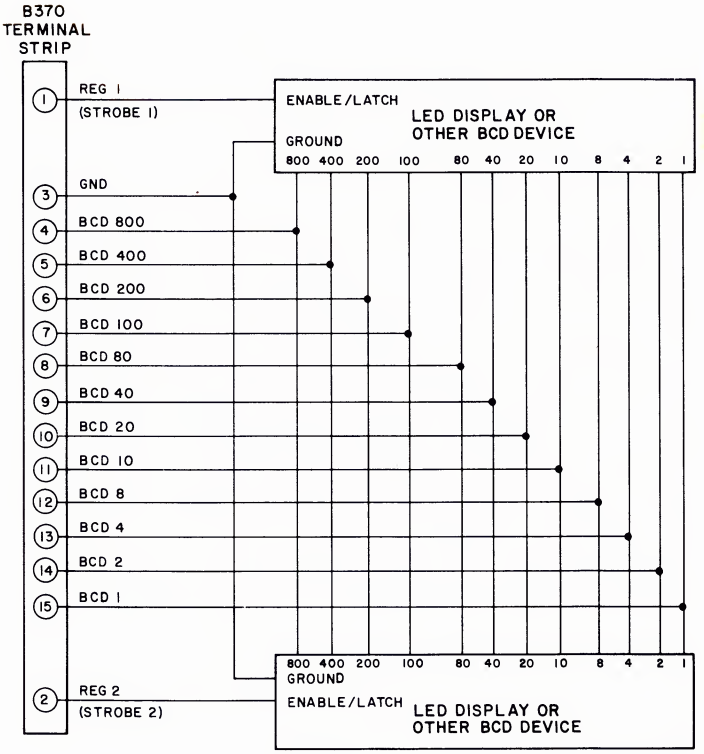
Output Levels	TTL & CMOS compatible (2 unit loads) Logic "0" 0.4 VDC @ 4 mA sink Logic "1" 3.3 VDC @ 1 mA source
Short Circuit Protection	0 to +24 VDC continuous
Current limit	8 mA (typical)
Module Isolation	1500 VRMS/2500 VDC for one minute 240 VAC continuous
Strobe Frequency	Synchronized to Micro 84 scan
Strobe Width	1 ms (typical)
Response Time	⩽8 ms (both channels)
Data/Strobe Format	0 to 999 counts in BCD Data - true high Strobe - true low
Throughput Rate	Both channels updated on each scan

Circuit Characteristics

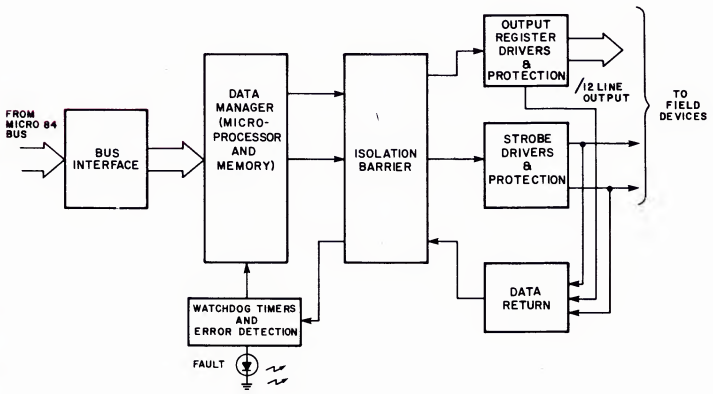
Topology	Two, 3-digit channels
Register Format	Nos. 4010, 4012, 4014, 4016, 4018, 4020, 4022, 4024

Environmental Requirements

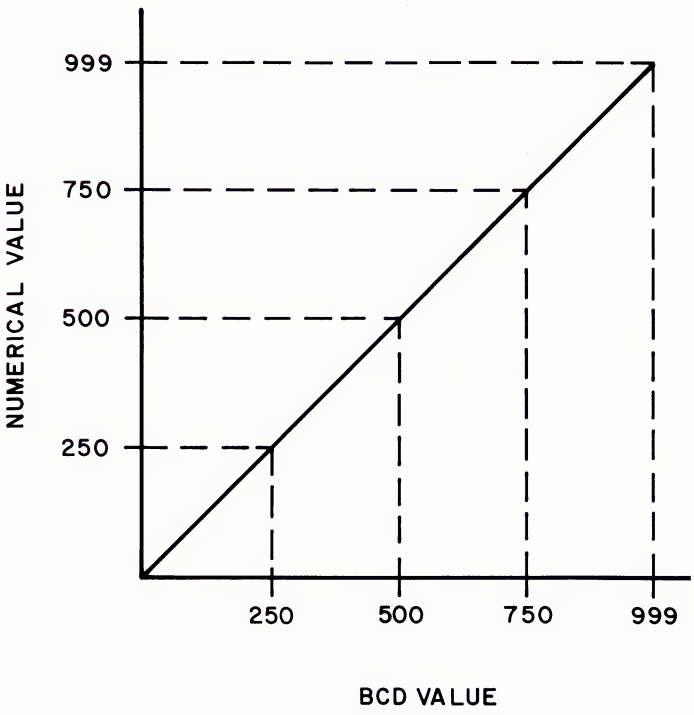
Operating Temperature	0 to 60°C
Humidity	0 to 95% (non-condensing)
Shock	15 G for 11 ms
Vibration	0.625 G, 50-500 Hz
EMI	MIL-STD-461-B
MI	Helmholtz coil (20 Gauss)
RFI	FCC Class A
Surge Withstand Capability (SWC)	IEEE STD. 472-1976 ANSI C37.90A-1976 (2500V, 1.5 MHz for 6μs) coupled and radiated
Dimensions (W x H x D)	1.63 in x 10.50 in x 5.50 in (41.40 mm x 266.70 mm x 139.70 mm)
Weight	1 lb (0.45 kg)
Termination	Screw terminals on removable wiring strip
Cable	25 feet maximum; longer if shielded; C_{max} = .047
Wire Size	Two #18 AWG (max)
Construction	Lexan
Indicator	FAULT (on when diagnostics fail)



B370, BCD Register Output Module
Terminal Numbering and Output Connections

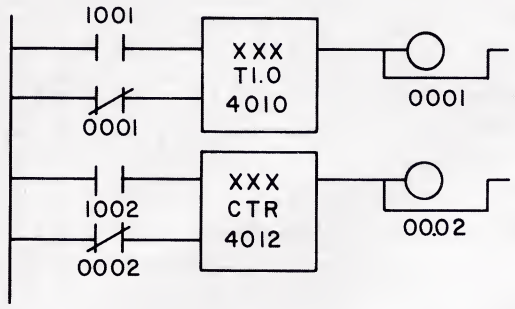


B370, BCD Register Output Module
Block Diagram



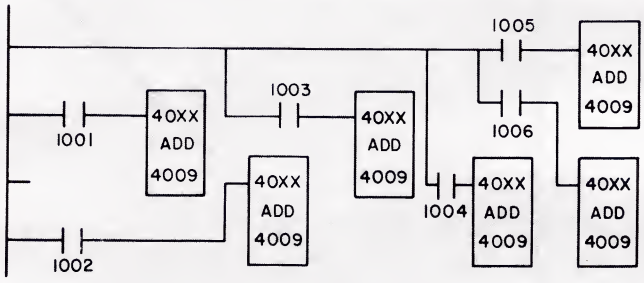
Numerical Output of B370 is Directly
Proportional to Output Value

Network No. 1 - Output a timer, counter, or sequencer value.



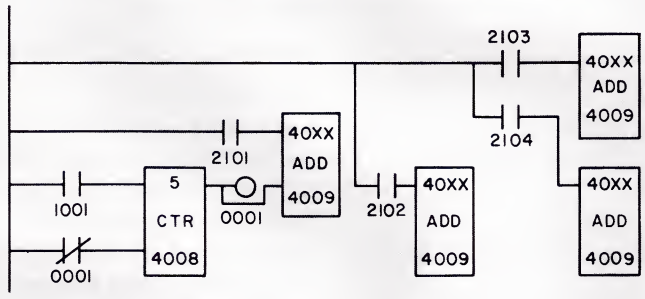
Network #1 demonstrates how to output register values to any field device. Register 4010 accumulates time and outputs its value to the B370. Similarly, register 4012 accumulates counts and outputs its value to the second B370 channel. "XXX" may be a constant or another register.

Network No. 2 - Output several registers to a single display using a rotary switch.



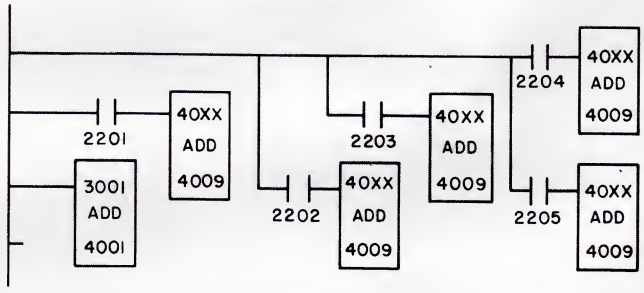
Network #2 shows how to output several internal registers to a single output register for display. Switches 1001 through 1006 are contacts of a rotary switch. Only one switch is ON at a time. Registers 40XX can be any register (including 3001 through 3004) except 4009 and 4010. (Register 4009 should be set to zero.) The display output register is 4010. To display additional registers, add similar logic in another network.

Network No. 3 - Output several registers to a single display using a pushbutton sequence.



Network #3 shows how to output several internal registers to a single output register for display. Switch 1001 is a pushbutton that increments sequencer register 4008. Registers 40XX can be any register (including 3001 through 3004) except 4008, 4009, and 4010. The display output register is 4010. (Register 4009 should be set to zero.) To display additional registers, add similar logic in another network.

Network No. 4 - Output several registers to a single display using a thumbwheel.



Network #4 demonstrates how to output several internal registers to a single output register for display. A thumbwheel increments sequencer register 4002 via additional register 4001. Registers 40XX can be any register (including 3002 through 3004) except 4001, 4002, 4009, and 4010. (Register 4009 should be set to zero.) To display additional registers, add similar logic in another network.

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B371-001 BCD Register Input Module DATA SHEET

The B371-001 BCD Register Input Module converts two, 12-bit binary coded decimal numbers to a numerical value and applies this value to the *Micro-84*[tm] controller.

FEATURES

- Two 3-digit channels
- Popular True High BCD Format
- Active or passive field device compatible
- Data inhibit capability during data selection
- TTL and CMOS compatible
- 12-bit BCD resolution
- Continuous on-line diagnostics
- Removable wiring strip
- Designed for harsh industrial environments
- Designed to meet UL and CSA standards

GENERAL DESCRIPTION

The B371-001 BCD Register Input is an input module for the *Micro-84* controller. It converts each of two 12-bit binary coded decimal (BCD) signals to a numerical value. This value ranges from 0 to 999. The actual numerical value is directly proportional to the BCD input. For example, if the BCD input increases 10 percent, the numerical output also increases 10 percent.

The BCD Register takes the numerical value and transfers it automatically to input registers 3001 through 3004. Once in one of these registers, the numberical value can control a timer, or a counter, or a sequencer. It can also be manipulated by arithmetic functions. Typically, the B371 is used in applications such as interfacing operator control panels with the *Micro-84*, set point control, and data acquisition.

Looking at the terminal numbering and connections diagrams, notice that the inputs to the B371 come from thumbwheels, keypads, panel meters, and other BCD compatible devices.

The format of this input is true high (positive) BCD with isolating diodes. These diodes are polarized so that the anode of each diode is connected to the thumbwheel switch common, and the cathode is connected to each input of the B371 12-line BCD bus. You can see this by looking at the connections diagram. This diagram shows the connections for two thumbwheels or other BCD devices. If you use only one, the diodes are not required. Digital panel meters should have tri-state outputs, if both channels are used.

Notice from the diagram that two BCD devices (or channels) are multiplexed to the B371 on one 12-line BCD bus. These channels are controlled by two strobes: Strobe 1 and Strobe 2. These strobes alternately select, in true high format, each channel at a through-put rate sufficient to update both channels on each scan of the *Micro-84*.

The B371 terminal strip shown on the diagram is the front panel connector.

This connector contains a removable male plug that contains 15-screw terminals. It is easily

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removed, which allows you to quickly replace the B371 without disturbing field wiring. For this wiring, you can use shielded or un-shielded wiring having a wire size of 14 to 22 AWG. The terminals are clearly marked. This allows you to make your field wiring connections quickly and easily.

Besides the connector with its removable plug, a FAULT indicator is also located on the front of the BCD Register.

The indicator is a troubleshooting aid. It turns on whenever the internal diagnostic test detects a failure. This test continuously exercises the following B371's internal circuits: random access memory (RAM), read only memory (ROM), and communications circuitry during each scan of the *Micro-84*. For predictability and safety, if the test detects multiple consecutive failures, it stops the *Micro-84's* scanning operation and turns on FAULT.

In addition to the FAULT indicator, Gould Modicon provides for an optional data change switch. This switch, when closed, prevents the B371 from reading incorrect values whenever you change thumbwheel settings or change settings of other field devices. Instead of a switch, you could use a keyswitch to prevent unauthorized tampering of thumbwheel or other field devices.

The BCD Register is easy to install. First it is housed in a lightweight, shielded, durable Lexan case. It contains mounting brackets at the rear of the case, which simplifies installation. Next, it can be mounted anywhere in the I/O structure. Connectors located on the left- and right-rear sides of the case plug into similar connectors on adjacent modules.

This plugging action automatically connects the B371 to the data bus of the *Micro-84*. If the B371 is the right-most module in the I/O structure, you plug a termination connector into the connector located on the right-rear side. This termination connector is shipped with the *Micro-84* controller. The *Micro-84* also provides the B371 with operating voltages through this connector. The B371 does not require a separate power supply.

The B371-001 Register Input meets the stringent requirements of both IEEE and ANSI standards for radiated surge withstand capability (SWC). The B371 also withstands the severe voltage transients, electromagnetic interference, and magnetic fields commonly encountered in an industrial environment.

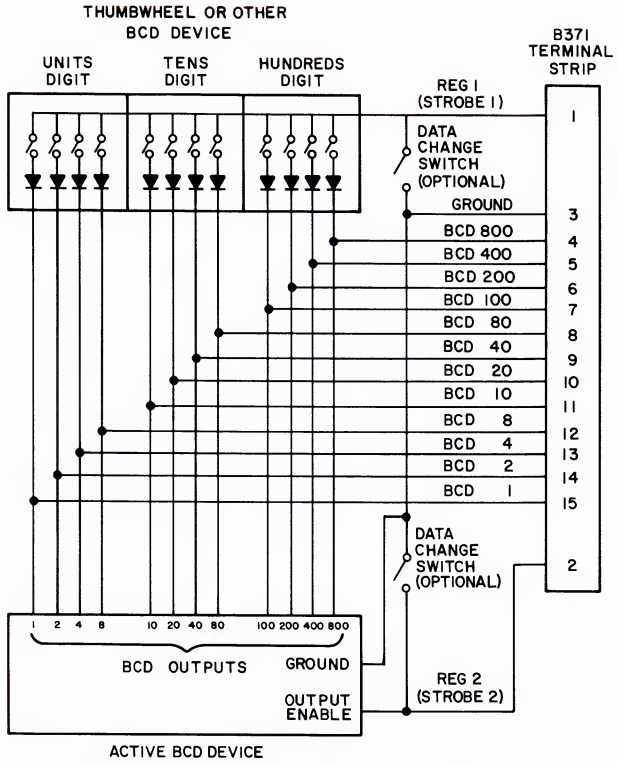
SPECIFICATIONS

Electrical Characteristics

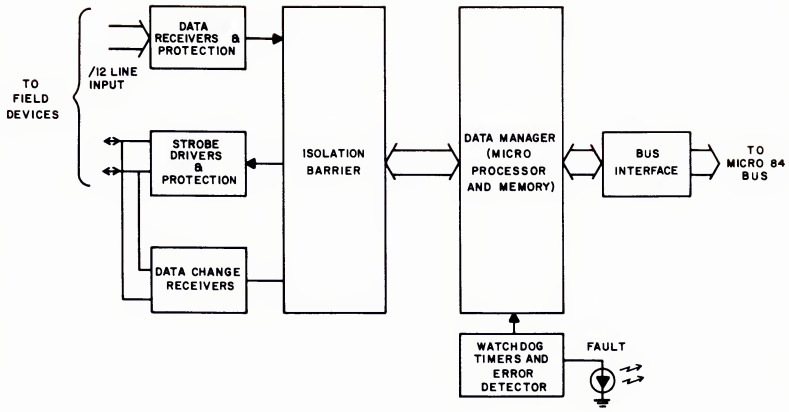
Input Range	0-24 VDC	Output Current Limit	4 mA (typical)
Levels	TTL or CMOS compatible	Module Isolation	1500 VRMS/2500 VDC for one minute
Bus Inputs	Logic "0" < 0.7 VDC Logic "1" > 2.4 VDC		240 VRMS continuous
Strobe Outputs	Logic "0" < 0.4 VDC @ 2 mA	Field Device Resistance	ON < 200 ohms OFF > 40K ohms
	Logic "1" > 4.0 VDC @ 2 mA	Multiplex Frequency	250 Hz (typical)
		Strobe Width	1 ms (typical)
Input/Output Protection	240 VAC continuous		

Circuit Characteristics

Topology	Two, 3-digit channels	Data Format	0 to 999 counts linear to inputs
Field Device	Passive or Active (tristate)		
Register Format	True High BCD Nos. 3001 & 3002 or Nos. 3003 & 3004	Throughput Rate	Both channels updated on each scan



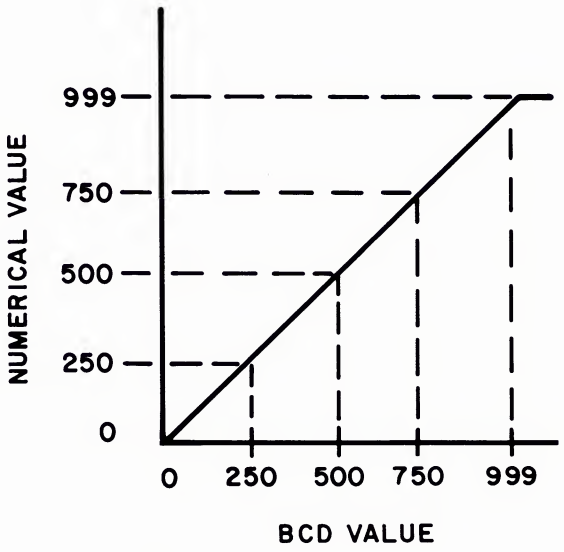
B371 BCD Register Input Module
Terminal Numbering and Input Connections



B371, BCD Register Input Module
Block Diagram

Environmental Requirements

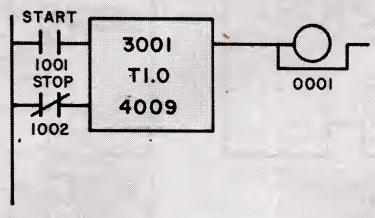
Operating Temperature	0 to 60°C
Humidity	0 to 95% (non-condensing)
Shock	15 G for 11 ms
Vibration	0.625 G, 50-500 Hz
EMI	MIL-STD-461B
MI	Helmholtz coil (20 Gauss)
RFI	FCC Class A
Surge Withstand Capability (SWC)	IEEE STD 472-1974 and ANSI C37.90-1974 (2500 V, 1.5 mHz for 6 μs) coupled
Dimension (W x H x D)	1.63 in x 10.50 in x 5.50 in (41.40 mm x 266.70 mm x 139.70 mm)
Weight	1 lb (0.45 kg)
Termination	Screw Terminals on removable wiring strip
Cable	25 feet maximum; longer if shielded
Wire Size	Two #18 AWG (max)
Construction	Lexan
Indicator	FAULT (ON when diagnostics fail)



Numerical Output of B371 is Directly
Proportional to Input BCD Value

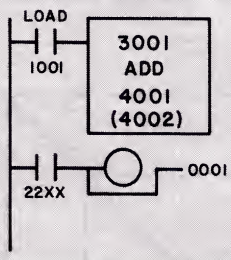
TYPICAL USER PROGRAMS

Network No. 1 - Simple Thumbwheel Entry for Timer, Counter, Sequencer Preset



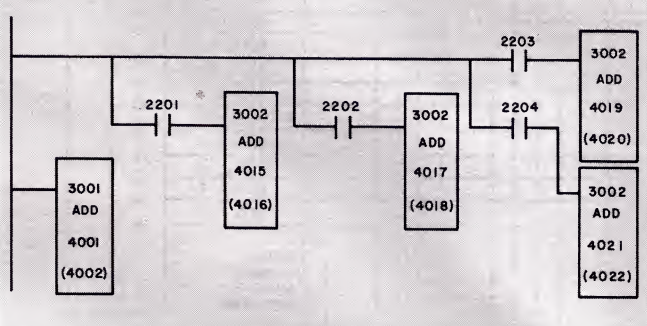
Network #1 demonstrates how to preset any register with a set of thumbwheels. Contact 1001 starts the timer and contact 1002 resets it. Wiring an optional data change switch as shown in the B371 Connection Diagram prevents erroneous data from getting into register 3001.

Network No. 2 - Thumbwheel Selection of Sequencer Step

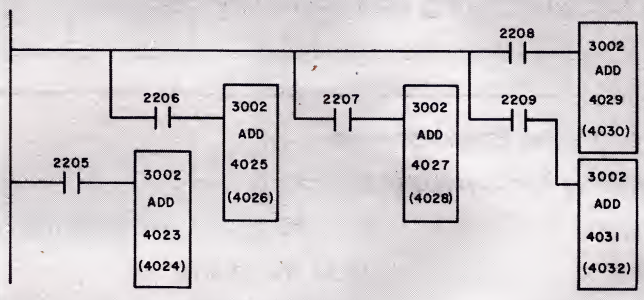


Network #2 shows how to force a sequencer to a particular step determined by a thumbwheel. Contact 1001 ON places the thumbwheel value into sequencer register 4002. This turns ON sequencer contact 22XX where "XX" is the thumbwheel value from 1 to 16. A zero value switches sequencer to the home position, therefore no contacts are activated.

Network No. 3 - Loading a Series of Registers with Two Thumbwheels



Network No. 4 - Loading a Series of Registers with Two Thumbwheels (cont)



Network #3 and #4 demonstrate how to load values into several registers using only two thumbwheels and one B371 BCD Register Input Module. One thumbwheel, addressed by register 3001, selects the internal register to receive data. Another thumbwheel, addressed by register 3002, selects the loaded numerical value. An addition function in register 4001 increments sequencer control in register 4002. To load an internal register 40XX, the contents of 3002 is added to another register (address 40XX-1). Sequencer control determines which addition register is executed. All registers are initialized to zero. For best results and safety, use the B371's data change capability.

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B373-001 0-10 VDC Analog Input DATA SHEET

The B373-001, 0-10 VDC Analog Input converts two 0-10 VDC analog signals to numerical values that range from 0 to 999 and feeds these values to the *Micro-84*[tm] controller.

FEATURES

- Two isolated channels
- Both channels 0-10 VDC compatible
- Differential inputs
- High Accuracy
- 10-bit resolution
- Self-contained power supply
- Optional Fanning Strip permits module removal without disturbing field wiring
- Designed for harsh industrial environments
- Designed to UL and CSA standards

GENERAL DESCRIPTION

The B373-001 0-10 VDC Analog Input is an input module for the *Micro-84* controller. It converts two 0-10 VDC analog signals to numerical values that range from 0 to 999. These values are directly proportional to the input. For example, if the input voltage increases 10 percent, the numerical output also increases 10 percent.

The Analog Input Module transfers these numerical values to input registers 3001 through 3004. Once in the registers, these values can be used to control timers, counters, sequencers; or it can be manipulated by arithmetic functions. Typically, the B373 is used in data acquisition and set point applications.

The varying voltages which are inputs to the B373, represents parameters such as pressure, level, temperature, humidity, weight and position. These inputs come from transmitters or transducers that may be located several hundred feet from the input module. You simply connect these inputs to a front-mounted, screw terminal strip. This strip is compatible with an optional Fanning Strip (P/N 0212-012), which allows quick module replacement without disturbing field wiring.

To simplify installation, the terminals on the strip are clearly marked as to which is channel 1 and which is channel 2, so that you can connect the varying d-c voltage operation to either or both channels.

The voltage input is actually a differential input to achieve high accuracy and significant noise immunity. Moreover, you can make the connections without adding more electronic components.

Besides the terminal strip, an OUT OF RANGE diagnostic indicator for troubleshooting is also located on the front of the B373 module. It flashes whenever the input is out of its prescribed range (0-10 VDC).

Both Channel 1 and Channel 2 inputs are isolated from each other. In addition, the inputs are isolated from all I/O modules connected to the *Micro-84* and from the *Micro-84* controller itself.

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The B373 is easy to install. First it is housed in a lightweight, shielded, durable Lexan case. It contains mounting brackets at the rear of the case which simplifies installation. Next, it can be mounted anywhere in the I/O structure. Connectors located on the left- and right-rear sides of the case plug into similar connectors on adjacent modules.

This plugging action automatically connects the Analog Input Module to the data bus of the *Micro-84*. If the B373 is the right-most module in the I/O structure, you have to plug a termination connector into the connector located on the right-rear side. This termination connector is shipped with the *Micro-84* controller. To minimize installation costs, the *Micro-84* provides the B373 with all operating voltages, thus eliminating the need for a separate power supply.

The B373 meets the stringent requirements of both IEEE and ANSI standards for radiated surge withstand capability (SWC). The B373 also withstands the severe voltage transients, electromagnetic interference, and magnetic fields commonly encountered in an industrial environment.

SPECIFICATIONS

Electrical Characteristics

Input Range	0-10 VDC
Resolution	1 of 999 counts
Voltage mode	10 mV per count
Accuracy	±0.1%/1 count @ 25°C ± 0.2%/2 counts @ 0-60°C

(You can recalibrate to ± 0.1% at a particular temperature between 0-60°C.)

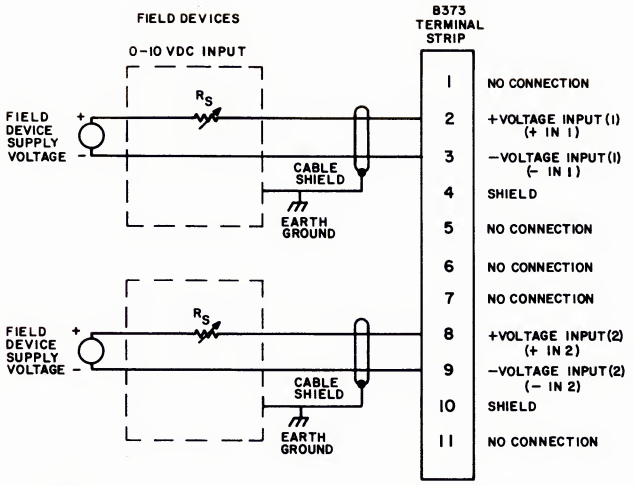
Linearity	0.05% of full scale
Input Impedance	1 Megohm, differential 0.5 Megohm each input to shield
Channel Isolation	19 V/-7 V (with respect to module shield terminal)
Module Isolation	1500 VRMS for one minute 440 VRMS continuous
Input Protection	240 VRMS
Common Mode Rejection	– 86 dB @ 50/60 Hz
Input Filter	– 3 dB down @ 18 Hz, rolloff 20 dB per decade
Crosstalk	– 86 dB

Circuit Characteristics

Topology	2 channels
Operating Mode	Independently selectable current or voltage
Register Format	Nos. 3001 & 3002 or Nos. 3003 & 3004
Data Format	0 to 999 counts linear to inputs
Throughput Rate	1.25 samples per second (each channel)

Environmental Requirements

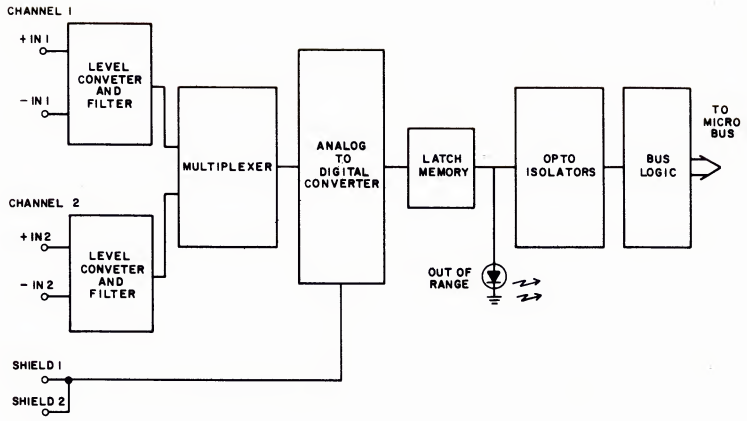
Operating Temperature	0 to 60°C
Humidity	0 to 95% (non-condensing)
Shock	15 G for 11 ms
Vibration	0.625 G, 50-500 Hz
EMI	MIL-STD-461B
MI	Helmholtz coil (20 Gauss)
RFI	FCC Class A
Surge Withstand Capability (SWC)	IEEE STD 472-1974 and ANSI C37.90-1974 (2500 V, 1.5 mHz for 6 μs) coupled



NOTES:

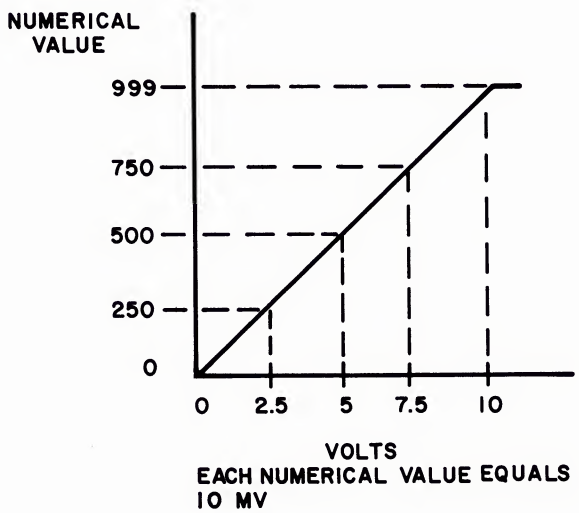
1. If earth ground is unavailable at field device, connect cable shield to shield terminal on module. DO NOT connect at both ends of cable.
2. For one voltage input connect Channels 1 & 2 in parallel.

B373, 0-10 VDC Analog Input Module
Terminal Numbering and Input Connections



B373, 0-10 VDC Analog Input Module
Block Diagram

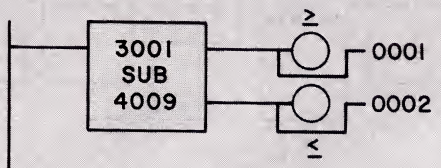
Dimensions (W x H x D)	1.63 in x 10.50 in x 5.50 in (41.40 mm x 266.70 mm x 139.70 mm)
Weight	1 lb (0.45 kg)
Termination	Screw terminals; Fanning Strip compatible
Wire Size	Two #14 AWG (max)
Construction	Lexan
Indicator	OUT OF RANGE



Relationship Between Numerical Value
and Voltage Inputs

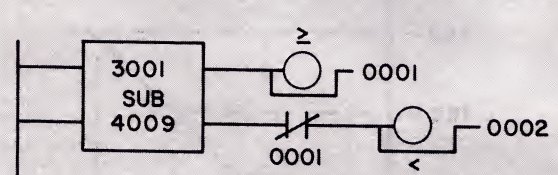
TYPICAL USER PROGRAMS

Network No. 1 - Simple Set Point Control



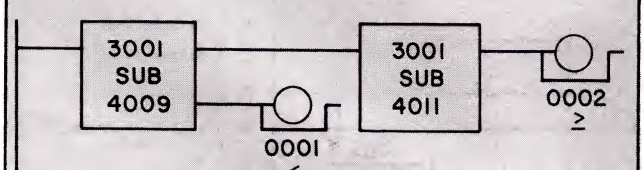
Network #1 compares the value from an analog input with a preset value in register 4009. If the input value is greater than or equal to the preset value, coil 0001 is ON. Conversely, if the input is less than or equal to the preset value, coil 0002 is ON. This comparison is performed on every *Micro-84* scan.

Network No. 2 - Set Point Control



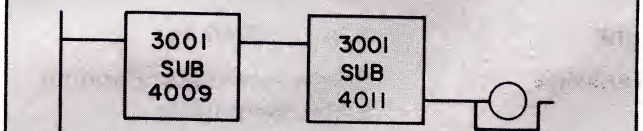
Network #2 performs a similar set point function as Network #1, but both coils do not go ON when the input value is equal to the preset value in register 4009. Coil 0002 is ON only when the input is less than the preset value. Greater than or equal input values turns on coil 0001. Alternately, a normally closed 0002 contact positioned prior to coil 0001 (while receiving contact 0001) will prevent equal values from turning ON coil 0001.

Network No. 3 - "Dead Band" Set Point Control



Network #3 will turn ON coil 0001 when the analog-input value is less than or equal to the preset in register 4009. Coil 0002 is ON when the input value is greater than or equal to the preset value in register 4011. The preset value in register 4011 is greater than the preset value in register 4009. Values between these will turn both coils OFF.

Network No. 4 - "Pass Band" Set Point Control



Network #4 performs the inverse of Network #3. Coil 0001 is ON only when the analog input is between or equal to preset values in registers 4009 and 4011. The preset value in register 4011 is greater than the preset value in register 4009.

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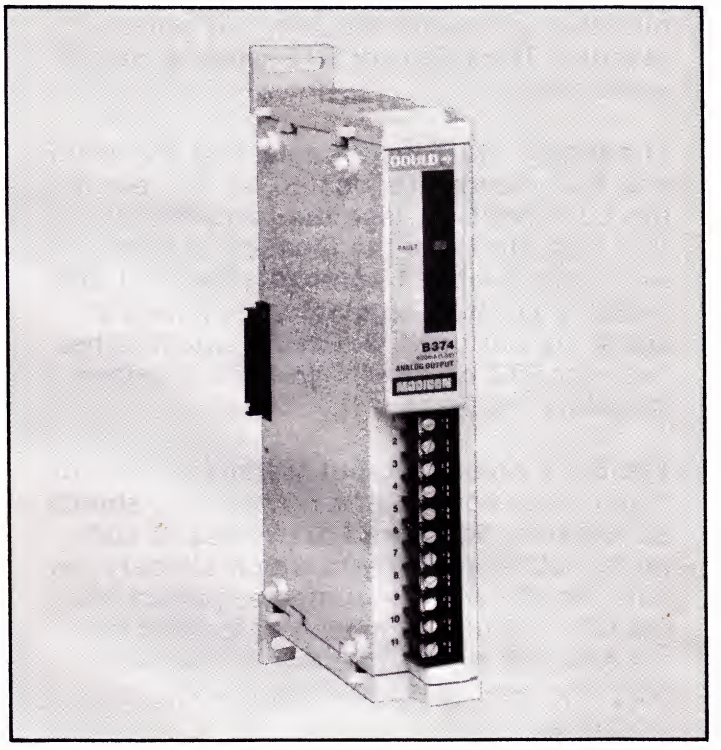
B374-001 / 4-20 mA, Analog Output Module DATA SHEET

The B374-001, 4-20 mA Analog Output Module receives numerical values that range from 0 to 999 from the Micro 84 Controller and converts them into two 4-20 mA output currents.

FEATURES

- Two isolated channels
- Popular 4-20 mA current outputs
- Current sink or source capability
- 10 bit resolution
- Voltage monitor outputs
- High accuracy and speed
- "Hold last value" or "reset to zero" user selectable
- Optional fanning strip permits module removal without disturbing field wiring
- Designed for harsh industrial environments
- Designed to meet UL and CSA standards



GENERAL DESCRIPTION

The B374-001 4-20 mA Analog Output is a dual channel output module for the *Micro 84 Controller*. It converts numerical values that range from 0 to 999 to an output current. This current ranges from 4 mA to 20 mA and is proportional to the input. For example, if the numerical input increases 10 percent, the output current also increases 10 percent.

The B374 is used to interface output registers with any 4-20 mA analog field device. Typical registers are timers, counters and sequencers. Typical analog field devices are valves, recorders, I/P converters, indicators, and servo controllers. You can connect these field devices to both a power supply and the B374 without using additional components. Field devices can be located several hundred feet from the output module.

Specifically, the B374 Analog Output module interfaces field devices with the following output registers: 4010, 4012, 4014, and 4016 of the 1K *Micro 84*, and 4010, 4012, 4014, 4016, 4018, 4020, 4022, and 4024 of the 2K *Micro 84*. The 1K *Micro 84* supports a maximum of two B374's, and the 2K *Micro 84* supports a maximum of four B374's.

Whichever *Micro 84* you use, it is important that you understand the addressing technique used by the controller and its register output modules. In addition to the B374, the controller can use other modules such as the B370 BCD Register Output Module. Either of these modules can be the first register output module. Whichever you use, the first module addresses module output registers 4010 and 4012. The second module, regardless of whether it is a B370 or a B374, addresses registers 4014 and 4016. The third and fourth modules, if used, address registers 4018 through 4024 in a similar manner.

The B374 Analog Output Module features two modes used with the *Micro 84*'s standby operation. (Standby means that the *Micro 84* is powered up but not scanning.) These two modes are "hold last output" (HOLD) or "return to zero" (RTZ). HOLD retains the value of the output current at the time the *Micro 84* switches to standby. RTZ switches the output current to zero, which is equivalent to an open circuit, whenever the *Micro 84* stops scanning. Scanning of the *Micro 84* can be stopped manually from

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the programming panel, or by a program pack, or by the internal diagnostics of the controller.

The RTZ and HOLD modes permit safer operation by allowing you to select the output condition best suited by your application, whenever the *Micro 84* enters standby. The HOLD or RTZ mode is switch selectable.

The toggle switches for selecting the HOLD and RTZ modes are located on the rear of the B374 housing, (see the last page of this data sheet for the location of these switches.) Switch 1 controls channel 1 and switch 2 controls channel 2. Switches 3 and 4 are not used. Set each switch either "up" for RTZ or "down" for HOLD before installing the B374.

The B374 Analog Output Module is easy to install. It is housed in a lightweight, shielded, durable, dripproof Lexan case. It contains mounting brackets which simplify installation. It can be mounted anywhere in the I/O structure. Connectors located on the left- and right-rear sides of the case plug into similar connectors on adjacent modules.

This plugging action automatically connects the B374 to the data bus of the *Micro 84* Controller. If the B374 is the right-most module in the I/O structure, plug a termination connector into the connector on the right-rear side. This termination connector is supplied with the *Micro 84* controller.

Field wiring is also easy to install. Connect field wiring to front-mounted, screw terminal strip. It is recommended that you use shielded, twisted-pair cable with insulating jacket to minimize radiated interference. The terminal strip is compatible with an optional Fanning Strip (P/N 0212-012), which allows quick module replacement without disturbing field wiring. All terminals are clearly marked for their intended function. The B374 requires an external power supply for its operating voltages. This same power supply can also be used to power one or both current loops.

Besides the terminal strip, a POWER indicator is also located on the front of the B374 module as a troubleshooting aid. This green indicator is on when the external power supply is connected to the module. When the POWER indicator is off, it shows that the module is not receiving its operating voltages and, thus, will not operate.

The screw terminal strip provides terminals that allow you to use a voltmeter to monitor the output current. Just connect a high impedance voltmeter between the VOLTAGE MON. (1 or 2) and CURRENT SOURCE (1 or 2) as shown in the "Terminal Numbering and Output Connections" diagram. The voltage will range from +1 to +5 VDC. It is proportional to the output current.

Both channel 1 and channel 2 outputs are isolated from each other and from all I/O modules connected to the *Micro 84*. In addition, the channels are isolated from the *Micro 84* controller itself.

The B374 meets the stringent requirements of both IEEE and ANSI standards for surge withstand capability (SWC). The module has been designed to meet the requirements of both UL and CSA standards. The B374 also withstands the severe voltage transients, electromagnetic interference, and magnetic fields commonly encountered in an industrial environment.

SPECIFICATIONS

Electrical Characteristics

Output Current Range	4-20 mA (0 mA when Micro 84 in standby and B374 in RTZ mode)
Monitor Voltage Range	1-5 VDC
Loop Power Supply	60 VDC (max)
Over Voltage Protection	240 VRMS
Load Resistance Range	$R_{max} = \frac{V_{loop} - 7}{.02}$ ohms $R_{min} = \frac{V_{loop} - 30}{.02}$ ohms V_{loop} = current loop supply volts
Loop Power Supply Range	for a known loop resistance R_L then: V_L (max) = .02 (R_L) + 30 V_L (min) = .02 (R_L) + 7 where V_L must **never** exceed 60 VDC
Voltage Monitor Output Impedance	220 ohms (typical)
Voltage Monitor Load	1 megohm (min)
Resolution	1 of 999 counts
Accuracy	± 0.2%/2 counts
Crosstalk	−66 dB
Settling Time	6.4 ms (95% of final value) 15 ms (99.9% of final value)
External Supply	22 to 30 VDC; 80 mA max.
Channel Isolation	500 VDC for one minute; 100 VDC continuous (channel-to-channel and channel-to-external supply)
Module Isolation	1500 VRMS/2400 VDC for one minute 440 VRMS continuous

Circuit Characteristics

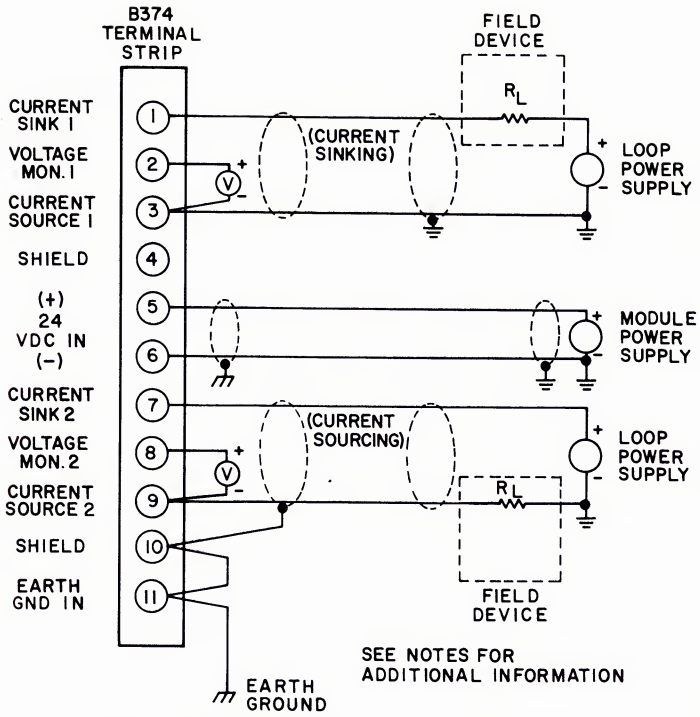
Topology	2 channels
Operating Modes	Hold or Return to Zero (each channel)
Register Format	Nos. 4010, 4012, 4014, 4016, 4018 4020, 4022, 4024
Data Format	0-999 counts linear with output current
Throughput Rate	Both channels updated on each scan

Environmental Requirements

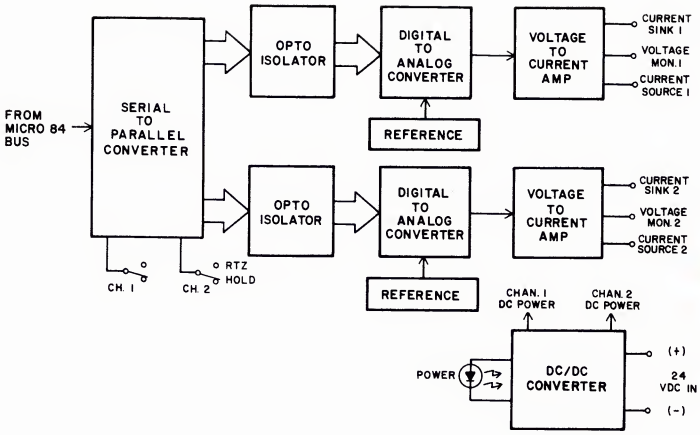
Operating Temperature	0 to 60°C
Humidity	0 to 95% (non-condensing)
Shock	15 G for 11 ms
Vibration	0.625 G, 50 to 500 Hz
EMI	MIL-STD-461-B
MI	Helmholtz Coil Test per TP-HELM-000
RFI	FCC Class A
Surge withstand capability (SWC)	IEEE STD. 472-1974 and ANSI C37.90A-1974 (2500 V, 1.5 mHz for 6μs) coupled
Dimensions (W x H x D)	1.63 in x 10.50 in x 5.50 in (41.40 mm x 266.70 mm x 139.70 mm)
Weight	1 lb (0.45 kg)
Termination	Screw Terminals; Fanning Strip compatible
Wire Size	Two #14 AWG (max)
Construction	Lexan
Indicator	POWER (indicates external power ON)

NOTES:

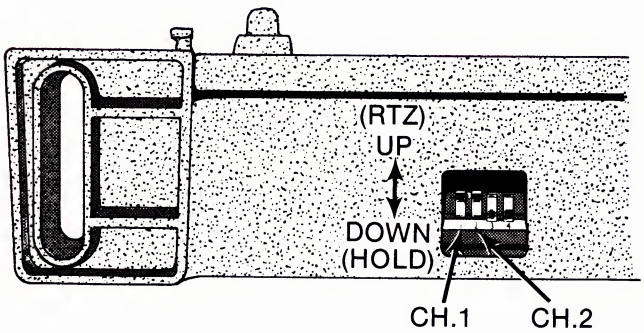
1. Each output may be configured for current sourcing or sinking loads. The "Connections" diagram shows the configuration for both. Use shielded cable for your field wiring.
2. To minimize electrical interference, ground the cable shield at either end of the cable but not at both ends. The preferred grounding is at the loop power supply. This grounding is shown in the "CURRENT SINKING" load configuration. You can also ground the cable to your B374 as shown in the "CURRENT SOURCING" load configuration. Be sure to connect the EARTH GND IN terminal to earth ground at your facility.
3. You can use either one loop power supply or the module external power supply to power both loops, provided it has sufficient drive capability.
4. To meet the requirements of FCC Regulation 20780, Class A; use shielded, twisted-pair cable to connect the power supply to your B374. It is recommended that you ground both ends of the cable as shown in the diagram.



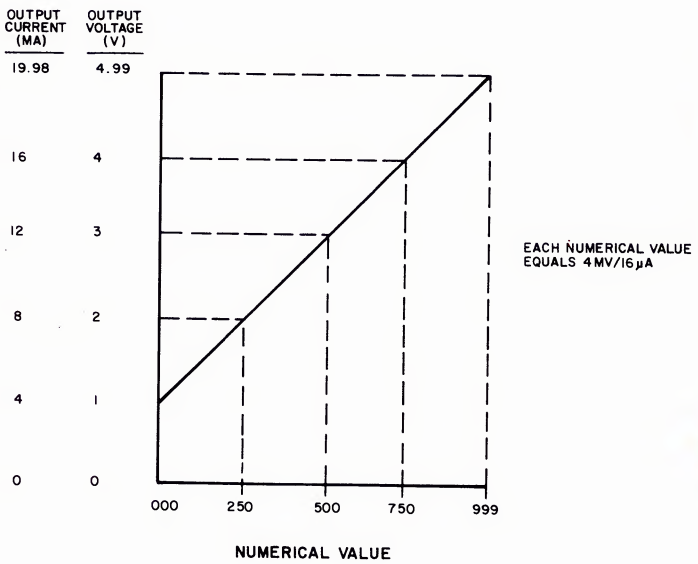
B374, 4-20 mA Analog Output Module
Terminal Numbering and Output Connections



B374, 4-20 mA Analog Output Module
Block Diagram



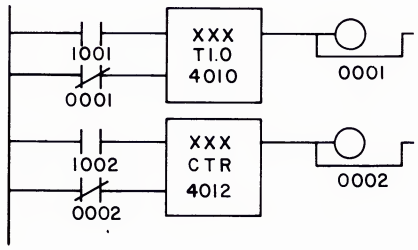
Rear View of B374 Showing Locations of
RTZ-HOLD Toggle Switches



Relationship Between Current/Voltage Output
and Numerical Input

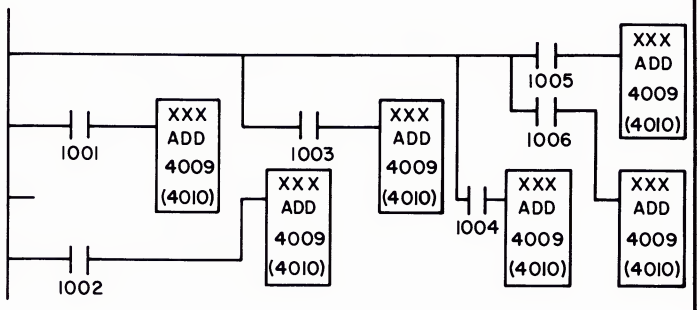
TYPICAL USER PROGRAMS

Network No. 1 - Output a timer, counter, or sequencer value.



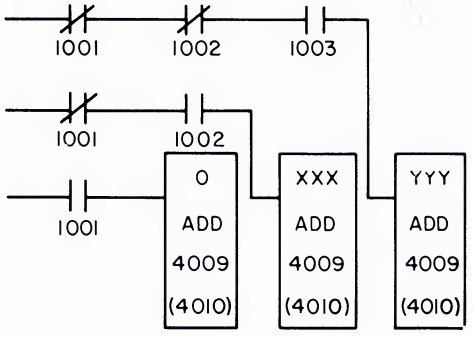
Network #1 demonstrates how to output register values to any field device. Register 4010 accumulates time and outputs its value to the B374. Similarly, register 4012 accumulates counts and outputs its value to the second B374 channel. "XXX" may be a constant or another register.

Network No. 2 - Output several constants to to an output using a rotary switch.



Network #2 shows how to output several constants to a single output register. Switches 1001 through 1006 are contacts of a rotary switch to select the appropriate constant. "XXX" may be any constant from 0 to 999. (Register 4009 should be set to zero.)

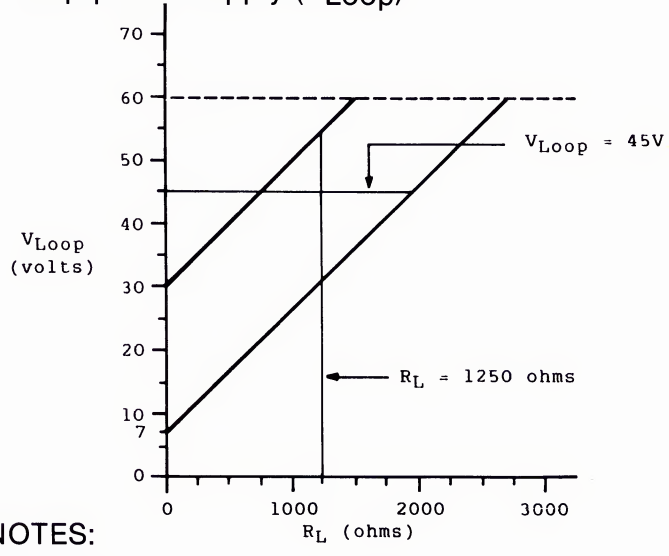
Network No. 3 - Simple Discrete-to-Analog Loop Control.



Network #3 demonstrates how to program discrete-to-analog loop control. It may be used for simple level, pressure, temperature, or position control. Switch 1001 controls the upper limit by forcing a zero value into output register 4010, thereby using the B374 to turn off an analog field device. Switch 1002 forces value "XXX" to output register 4010 and the field device. Similarly, switch 1003 forces value "YYY". Generally, "YYY" is greater than "XXX". For greater resolution, expand the program with additional inputs to register 4009.

How to determine...

1. The loop power supply (V_{Loop}) knowing the load resistance (R_L).
2. The load resistance (R_L) knowing the loop power supply (V_{Loop}).



NOTES:

1. For a loop power supply (V_{Loop}) of 45V, the load resistance (R_L) can range between 750 and 1900 ohms.
2. For a load resistance (R_L) of 1250 ohms, the loop power supply (V_{Loop}) can range between 32 and 55 volts.
3. V_{Loop} can never exceed 60 volts.

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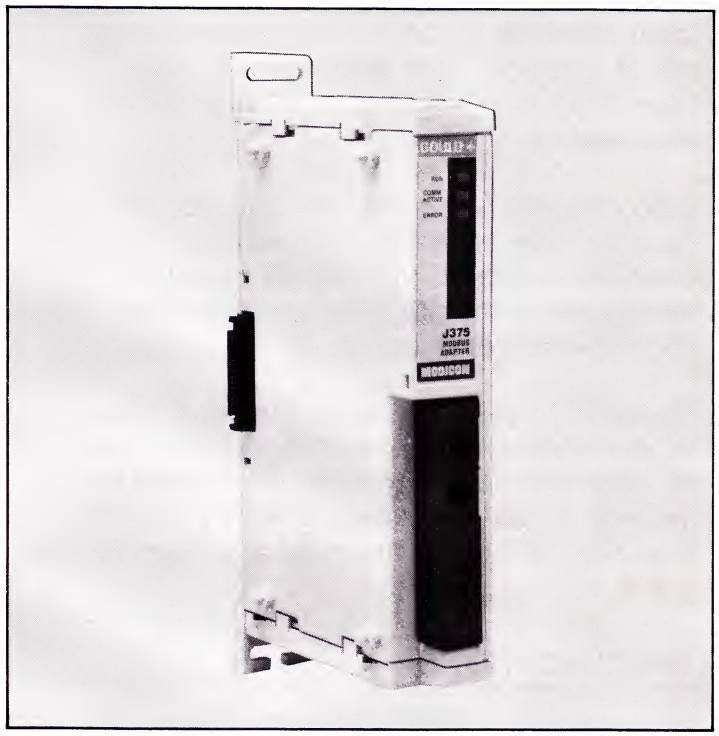
J375 Modbus Adapter DATA SHEET

The J375 *Modbus*® adapter is a communications interface for the *Micro 84*™ controller.

FEATURES

- Connects Micro 84 (slave) to Modbus communications system
- Addressing for 247 slaves on one system
- Mounting and packaging similar to Micro 84 I/O modules
- No modifications required to Micro 84
- One RS-232-C port
- Compatible with Modicon J378 modem plus many commercial modems
- Permits simultaneous P370 programming and Modbus communications
- Comprehensive diagnostic capability and extensive error checking
- Switch selectable address and system parameters
- Supports mixed Modicon PC network



GENERAL DESCRIPTION

The J375 Modbus Adapter is a communications interface module for the Micro 84 controller. As such, it interfaces the Micro 84 to a Modbus industrial communication system. It allows the Micro 84 to be a slave PC to a Modbus master.

The adapter is packaged in a modified Micro 84 I/O module case. This case is made of Lexan molded plastic with mounting brackets located on the rear of the case. This makes the J375 lightweight and easy to install.

The J375 provides port connections for the following: A P370 Micro 84 Programmer, an RS-232-C device and a Micro 84 controller.

In addition, the adapter is equipped with factory selectable options for 115/220 VAC power. The J375 contains its own power supply that generates all operating voltages for the adapter's internal processor. The J375 does not require power from the Micro 84 or the data bus.

The adapter provides three LED indicators. "Run", "Comm Active", and "Error". These indicators display both operating status and trouble indications. You can use these indicators for fast troubleshooting.

The J375 provides dip switches at the rear of its case for address and system parameter selection.

The Modbus adapter supports function codes 1-8 and 15-19. In addition, the J375 allows simultaneous use of both the Modbus port and P370 port. In the event of a conflict, the adapter gives the Modbus port the higher priority, and the P370 port monitors operations only.

The J375 assures maximum system integrity through parity and message redundancy checks, exception responses, loopback diagnostics and automatic retries.

The J375 Modbus Adapter is compatible with all current Modbus products, which allows a mix of Gould Modicon PC's on a Modbus network.

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numbering and connections diagram. For voltage operation, simply remove this shorting bar.

Besides the terminal strip, an OUT OF RANGE diagnostic indicator for troubleshooting is also located on the front of the B375 module. It flashes whenever the input is out of its prescribed range (4 to 20 mA or 1 to 5 V). This indicator will also show that one of the input wires is either shorted to ground or open.

Both channel 1 and channel 2 inputs are isolated from each other. In addition, the inputs are isolated from all I/O modules connected to the *Micro-84* and from the *Micro-84* controller itself.

The B375 is easy to install. First it is housed in a light-weight, shielded, durable Lexan case. It contains mounting brackets at the rear of the case which simplify installation. Next, it can be mounted anywhere in the I/O structure. Connectors located on the left- and right-rear sides of the case plug into similar connectors on adjacent modules.

This plugging action automatically connects the Analog Input Module to the data bus of the *Micro-84*. If the B375 is the rightmost module in the I/O structure, you plug a termination connector into the connector located on the right-rear side. This termination connector is shipped with the *Micro-84* controller. To minimize installation costs, the *Micro-84* provides the B375 with all operating voltages, thus eliminating the need for a separate power supply.

The B375 meets the stringent requirements of both IEEE and ANSI standards for radiated surge withstand capability (SWC). The B375 also withstands the severe voltage transients, electromagnetic interference, and magnetic fields commonly encountered in an industrial environment.

SPECIFICATIONS

Electrical Characteristics

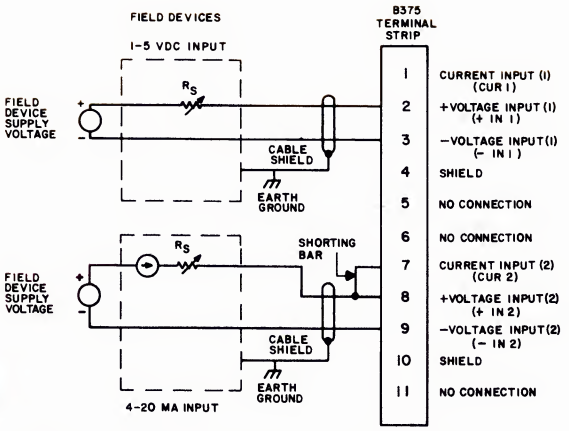
Input Range	4-20 mA or 1-5 VDC
Resolution	
current mode	1 of 999 counts 16 μA per count
voltage mode	4 mV per count
Accuracy	± 0.1%/1 count @ 25°C ± 0.3%/3 counts @ 0-60°C*

*(You can recalibrate to ± 0.15% at a particular temperature betwen 0-60°C.)

Linearity	0.1% of full scale
Input Impedance	
current mode	250 ohms
Crosstalk	– 86 dB
voltage mode	1 Megohm, differential 0.5 megohm each input to shield
Input Protection	240 VRMS
Channel Isolation	20 V/-9.5 V (with respect to module shield terminal)
Module Isolation	1500 VRMS for one minute 440 VRMS continuous
Common Mode Rejection	– 86 dB @ 50/60 Hz
Input Filter	– 3 dB down @ 18 Hz; rolloff 20 dB per decade

Circuit Characteristics

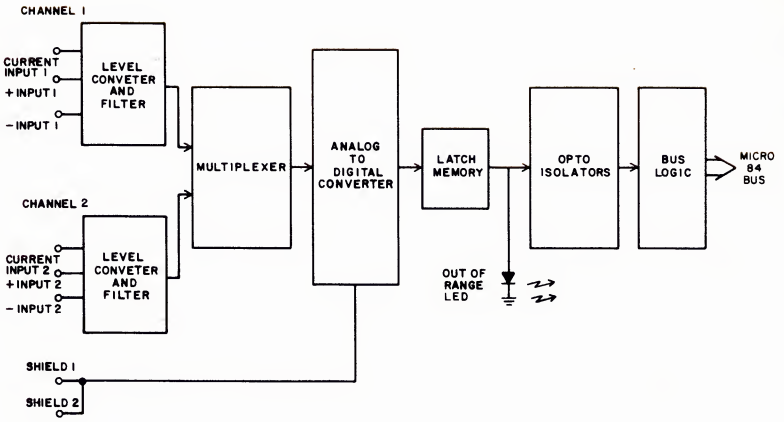
Topology	2 channels
Operating Modes	Independently selectable current or voltage
Register Format	Nos. 3001 & 3002 or Nos. 3003 & 3004
Data Format	0 to 999 counts linear to inputs
Throughput Rate	1.25 samples per second (each channel)



NOTES:

1. If earth ground is unavailable at field device, connect cable shield to shield terminal on module. DO NOT connect at both ends of cable.
2. For one voltage input connect Channels 1 & 2 in parallel; for one current input connect Channels 1 & 2 in series.

B375, 4-20 mA Analog Input Module
Terminal Numbering and Input Connections



B375, 4-20 mA Analog Input Module
Block Diagram

Environment

Operating Temperature	0 to 60°C
Humidity	0 to 95% (non-condensing)
Shock	15 G for 11 ms
Vibration	0.625 G, 50-500 Hz
EMI	MIL-STD-461B
MI	Helmholtz coil (20 Gauss)
RFI	FCC Class A
Surge withstand capability (SWC)	IEEE STD 472-1974 and ANSI C37.90-1974 (2500 V, 1.5 mHz for 6 μs) Coupled

Dimension (W x H x D) 1.63 in x 10.50 in x 5.50 in (41.40 mm x 266.70 mm x 139.70 mm)

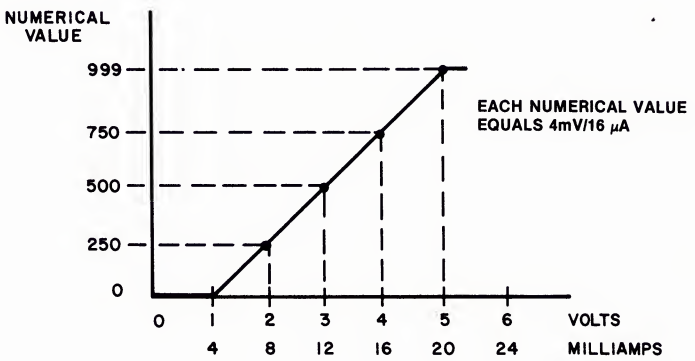
Weight 1 lb (0.45 kg)

Termination Screw Terminals; Fanning Strip Compatible

Wire Size Two #14 AWG (max)

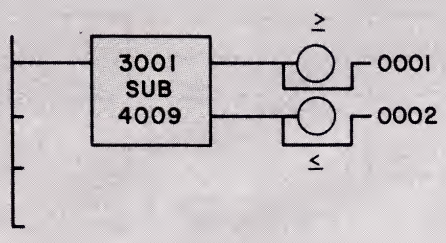
Construction Lexan

Indicator OUT OF RANGE



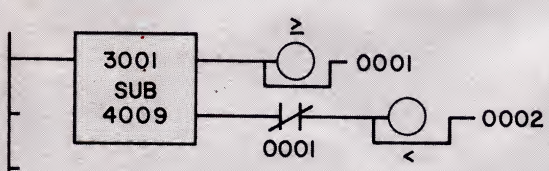
Relationship Between Numerical Value and Voltage/Current Inputs

Network No. 1 - Simple Set Point Control



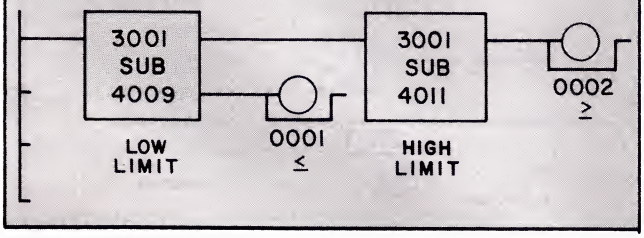
Network #1 compares the value from an analog input in register 3001 with a preset value in register 4009. If the input value is greater than or equal to the preset value, coil 0001 is ON. Conversely, if the input is less than or equal to the preset value, coil 0002 is ON. This comparison is performed on every *Micro-84* scan.

Network No. 2 - Set Point Control



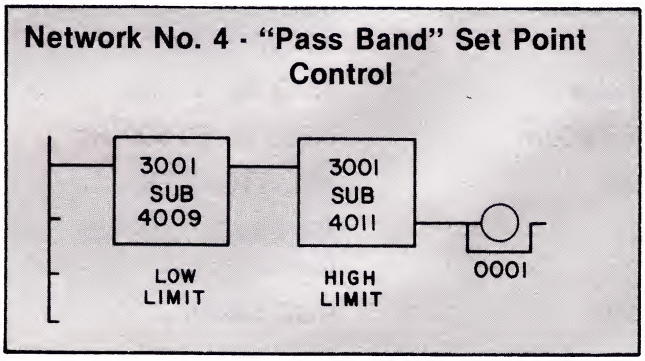
Network #2 performs a similar set point function as Network #1, but both coils do not go ON when the input value in register 3001 is equal to the preset value in register 4009. Coil 0002 is ON only when the input is less than the preset value. Greater than or equal input values turn on coil 0001. Alternatively, a normally closed 0002 contact positioned prior to coil 0001 (while removing contact 0001) will prevent equal values from turning ON coil 0001.

Network No. 3 - "Dead Band" Set Point Control



Network #3 will turn ON coil 0001 when the analog input value is less than or equal to the preset value in register 4009. Coil 0002 is ON when the input value is greater than or equal to the preset in register 4011. The preset value in register 4011 is greater than the preset value in register 4009. Values between these will turn both coils OFF.

Network No. 4 - "Pass Band" Set Point Control



Network #4 performs the inverse of Network #3. Coil 0001 is ON only when the analog input is between or equal to preset values in registers 4009 and 4011. The preset value in register 4011 is greater than the preset value in register 4009.

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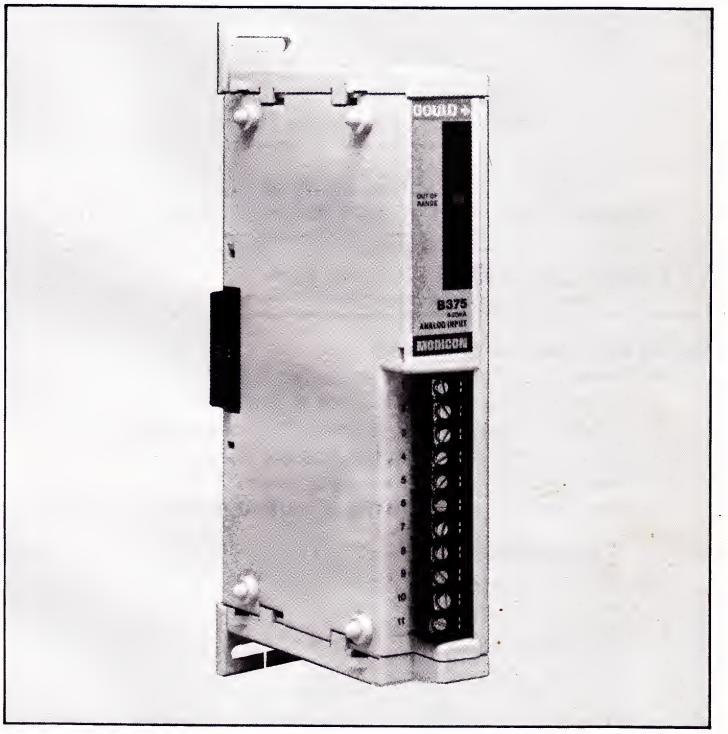
GOULD
Electronics

B375-001 4-20 mA Analog Input Module DATA SHEET

The B375-001, 4-20 mA Analog Input Module converts two 4-20 mA, or two 1-5 VDC analog signals, or one of each to numerical values that range from 0 to 999 and applies these values to the *Micro-84*™ controller.

FEATURES

- Two isolated channels
- Both channels 4-20 mA and 1-5 VDC compatible
- Differential inputs
- High accuracy
- 10-bit resolution
- Self-contained power supply
- Optional Fanning Strip permits module removal without disturbing field wiring
- Designed for harsh industrial environments
- Designed to UL and CSA standards



GENERAL DESCRIPTION

The B375-001 4-20 mA Analog Input is an input module for the *Micro-84* controller. It converts two 4-20 mA, or two 1-5 VDC analog signals, or one of each to numerical values that range from 0 to 999. These values are directly proportional to the input. For example, if the input current or voltage increases 10 percent, the numerical output also increases 10 percent.

The Analog Input Module transfers these numerical values to input registers 3001 through 3004. Once in the registers, these values can be used to control timers, counters, sequencers; or it can be manipulated by arithmetic functions. Typically, the B375 is used in data acquisition and set point applications.

The varying current/voltage, which are inputs to the B375, represent parameters such as pressure, level, temperature, humidity, weight and position. These inputs come from transmitters or transducers that may be located several hundred feet from the Input Module. You simply connect these inputs to a front-mounted, screw terminal strip. This strip is compatible with an optional Fanning Strip (P/N 0212-012), which allows quick module replacement without disturbing field wiring.

To simplify installation, the terminals on the strip are clearly marked so that you can connect either the 4-20 mA current loop or the varying d-c voltage (1-5 V) operation to each channel. (The voltage input is actually a differential input to achieve high accuracy and significant noise immunity.) Moreover, you can make the connections without adding more electronic components.

To further simplify installation, the B375 is factory configured in the current loop mode using shorting bar between terminals 1 and 2 and 7 and 8, as shown on the terminal

55

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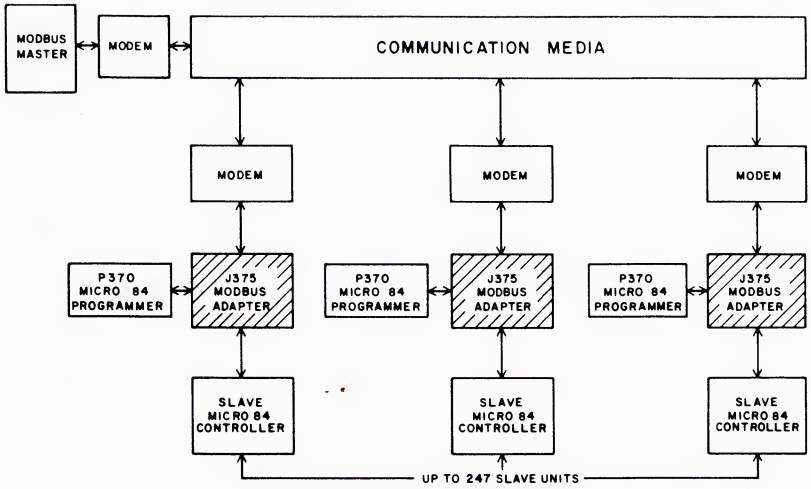
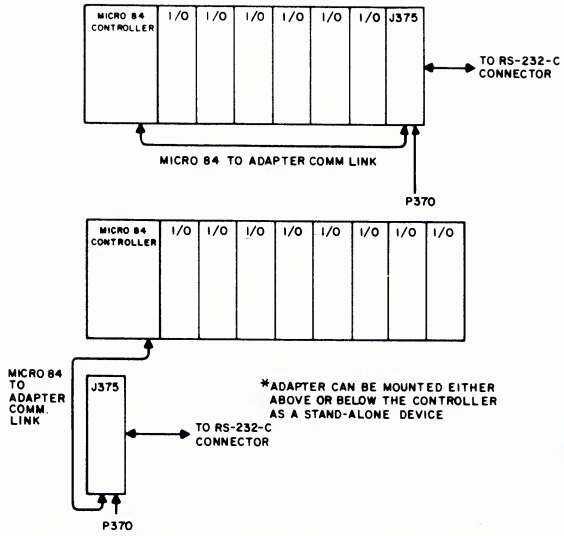


Typical Modbus Network
Showing Placement of J375 Modbus Adapter Within Network



Two Possible Mounting Configurations

SPECIFICATIONS

EIA RS-232-C Signals Supported

1. Transmitted Data (TXD), an output from the J375
2. Received Data (RXD), an input to the J375
3. Request to Send (RTS), an output from the J375
4. Clear to Send (CTS), an input to the J375
5. Data Set Ready (DSR), an input to the J375
6. Data Terminal Ready (DTR), an output from the J375

Modbus Compatibility

Baud Rate supported by J375

75	1,200
110	2,400
134.5	4,800
150	9,600
300	19,200
600	

Transmission mode, stop bits, and parity supported by J375

Parity Option	Even Parity		Odd Parity		No Parity	
No. of Stop Bits	1	2	1	2	1	2
ASCII	X	X	X	X	NS	X
RTU	X	NS	X	NS	X	NS

X = Supported
NS = Not Supported

Function Codes	Sub-Functions	Description	Supported	Not Supported
1		Read Output Status	X	
2		Read Input Status	X	
3		Read Output Register	X	
4		Read Input Register	X	
5		Force Single Coil	X	
6		Set Single Register	X	
7		Read Exception Status	X	
8	0	Loopback	X	
	1	Initiate Comm Restart	X	
	2	Return Diagnostic Register	X	
	4	Force Listen Only Mode	X	
9		Program (484 PC only)		X
10		Poll (484 PC only)		X
11		Fetch Event Counter		X
12		Fetch Communications Event Log		X
13		Program (184/384/584 PC's)		X
14		Poll (184/384/584 PC's)		X
15		Force Multiple Coils	X	
16		Set Multiple Registers	X	
17		Report Slave ID	X	
18		Program Commands (Micro 84 PC) (Gould Modicon (Proprietary Command)	X	
19*		Reset Link Command	X	

*Function Code 19 is a new function code. This code, via the Modbus master software, changes the values of the system parameters set by the dip switches.

Environment

Ambient Temperature	
Operating	0°C to 60°C
Storage	−40°C to +85°C
Humidity	0-95% (non-condensing)

Dimensions (W x H x D)	1.63 in x 10.50 in x 5.50 in (41.40 mm x 266.70 mm x 139.70 mm)
Weight	2 lbs, 2.5 oz (0.978 kg)

NOTES

1. Install as the last module in the I/O structure, if J378 modem not used.
2. Install anywhere within the range of the Micro 84 cable (cable is 6 ft. long and interchangeable with P370 cable).

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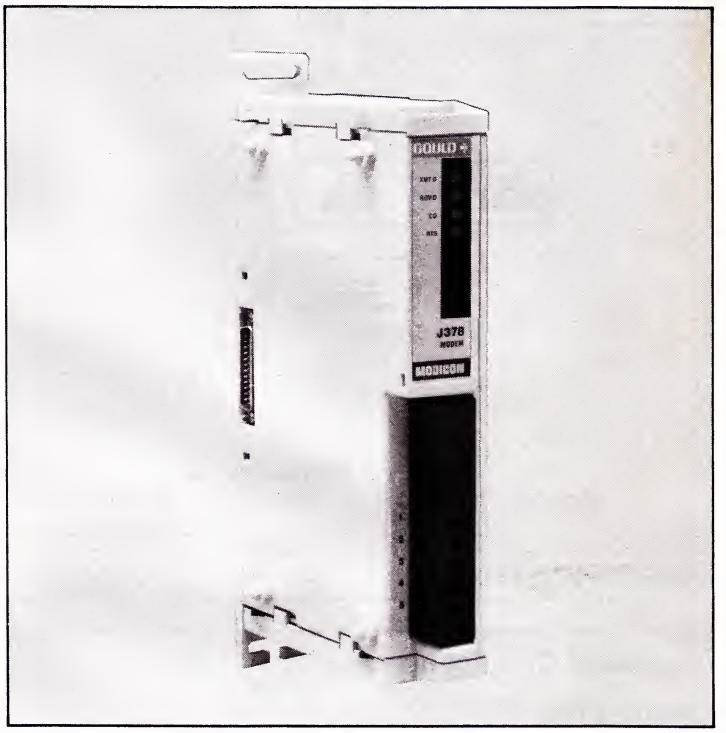
GOULD *Electronics*

J378 Modem
DATA SHEET

The J378 Modem allows a J375 *Modbus*® Adapter to be used with a 4-wire, twisted pair, fully shielded cable network.

FEATURES

- Allows short-haul data transfer for in-plant *Micro 84*™ controller
- Allows transmission over a 4-wire, twisted pair cable
- Designed for harsh industrial environment
- Low cost
- Easy to install
- Operates asynchronously at speeds up to 19,200 bps
- Uses frequency shift keying (FSK) to maximize noise immunity
- Tolerates a maximum signal loss of 35 dB
- Operates in half-duplex transmission mode
- Does not require an additional power supply
- Monitors certain EIA control signals via LEDs
- Mounting and packaging similar to Micro 84 I/O modules
- Compatible with Gould Modicon J478 Modem



GENERAL DESCRIPTION

The J378 Modem allows a J375 Modbus Adapter to be used with a 4-wire, twisted pair cable network, when the cable is used in a multipoint environment. It attaches to the right side of the J375 and receives both power and RS-232-C signals from the adapter. It connects to the 4-wire, twisted pair cable by way of a terminal strip on the front of the modem.

The J378 uses FSK modulation that is compatible with the J478 Stand-alone Modem. The J378 meets or exceeds the specifications for the J478 Modem, except for voice communications. The J378 does not have voice communication capability.

The J378 attaches to the right side of the J375 Modbus Adapter through the RS-232-C port on the adapter. Attaching the modem to the adapter dedicates the RS-232-C port for use by the modem.

The J378 interfaces with the Modbus twisted-pair cable network through four terminals on the front of the modem. You simply connect the twisted-pairs directly to the terminals on the front of the unit. The terminals are clearly marked as to which is receive and which is transmit. The J378 supports the Modbus 4-wire, twisted pair cable network only.

The J378 uses four LED indicator lights to display operating status.

XMIT D	(Transmit Data to cable)
RCV D	(Receive Data from cable)
CD	(Carrier Detect from cable)
RTS	(Request to Send from J375 Adapter)

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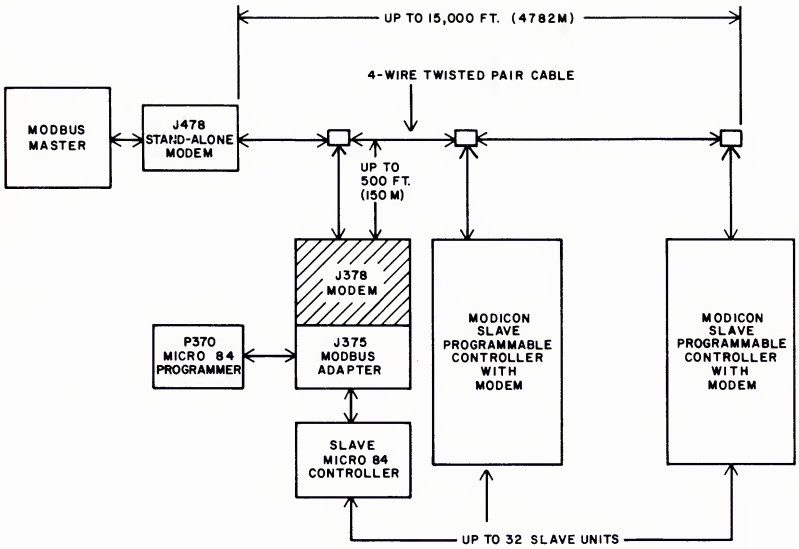
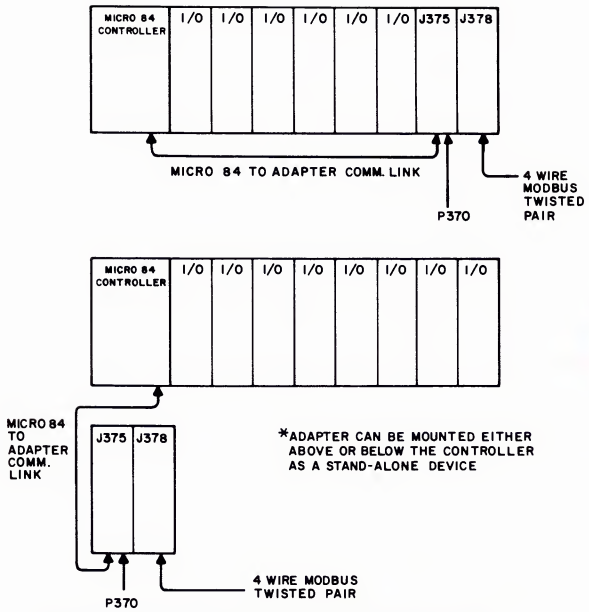


Typical Modbus Network
Showing Placement of J378 Modem Within Network



Two Possible Mounting Configurations

SPECIFICATIONS

Electrical Characteristics

Mark Frequency	50 kHz
Space Frequency	80 kHz
Maximum Data Rate	20 kHz
Form of Modulation	Frequency Shift Keying
Allowable Signal Attenuation	35 dB
Max. No. of Drops	32*
Max. Cable Length	15,000 ft*
Transmission Media	Four conductor, fully shielded twisted-pair cable (i.e., Belden 8777)
Type of Transmission	Asynchronous

*Main cable, drop lengths, and number of slaves are all inter-related parameters. For instance, the 15,000 ft. maximum length can be increased if less than 32 slaves are used.

Environment

Ambient Temperature	
Operating	0° to 60°C
Storage	−50° to +85°C
Humidity	0 to 95% (non-condensing)

Dimensions (W x H x D)

1.63 in x 10.50 in x 5.50 in
(41.40 mm x 266.70 mm x 139.70 mm)

Weight

1 lb, 5.5 oz (0.610 kg)

NOTES

1. Install as the last module in the I/O structure.
2. Install anywhere within the range of the Micro 84 cable (cable is 6 ft. long and interchangeable with P370 cable).

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Micro 84/P190 Programmer/Tape Loader DATA SHEET

The Gould Modicon Programmer/Tape Loader cartridge permits programming of the Micro 84 Programmable Controller by the P190 CRT Programmer.

FEATURES

- Programmer and Tape Loader Functions
- Element Editing
- Network Editing
- 4 x 7 Ladder Logic Display
- Element Status Display
- Partial and Full Reference Screens
- Network Create, Replace, Exchange and Delete
- Logic Expand and Compress
- Program Load, Record and Compare
- Program Documentation

GENERAL DESCRIPTION

The Gould Modicon Programmer/Tape Loader cartridge, used in conjunction with the Micro 84 Programmable Controller, the J375 Modbus Adapter, and the P190 full-family CRT Programmer, provides programming functions for program preparation, editing, documentation, debug, and system maintenance. With Programmer/Tape Loader, the user can perform local programming functions on the plant floor or expand the Micro 84 controller's versatility by performing remote programming and tape loading operations. In addition, it provides control for starting and stopping the Micro 84 controller, reporting its configuration, and writing the program pack.

There are two programming options: **Element Editing** and **Network Editing**. **Element Editing** permits the user to make entries and/or changes directly into the Micro 84 controller's memory. **Network Editing** permits the user to make changes in the P190 programmer's memory before making changes in the Micro 84 controller's memory. With **Network Editing**, the user can experiment with network changes while preserving existing logic. Both editors can read existing networks, create new networks, edit networks, disable and force elements, report full or partial reference tables, report coil usage tables, and perform element searching. **Network Editing** offers the additional capability of deleting, replacing, exchanging, compressing, and expanding networks.

Four Tape Loader functions allow the user to:

1. **Load** from the P190 tape to the Micro 84.
2. **Record** the Micro 84 memory onto the P190 tape.
3. **Compare** the Micro 84 memory with the P190 tape.
4. **Write** the Micro 84 memory onto the program track.

The **Load** function allows the user to construct new programs by loading and later editing selected networks from a previously prepared program. **Record** enables the user to preserve a copy of the program on a P190 tape for later use. A program may also be recorded on a Micro 84 program pack by **Writing** the program pack function.

Compare is used to verify that the Micro 84 controller's memory contains the same program as that on a P190 tape. Comparison may be performed on all memory, selected networks, or selected registers. The user may also select a log-and-pause or continuous-log mode for reporting miscompares.

The Programmer/Tape Loader cartridge plugs directly into the P190 tape transport. Local use requires a Gould Modicon J375 Modbus Interface. Remote use requires a J375 plus Gould Modicon J378 and J478 modems (or commercial equivalents). A P190 cable (either AS-W806-OXX or AS-W364-OXX) provides the communications link between the P190 and J375. When using a J375, the user must set port parameters and address selection on both the J375 and P190 programmer. A hard copy printout of the P190 programmer's CRT screen is obtained by connecting an RS-232-C compatible printer to the P190 programmer's second communications port.

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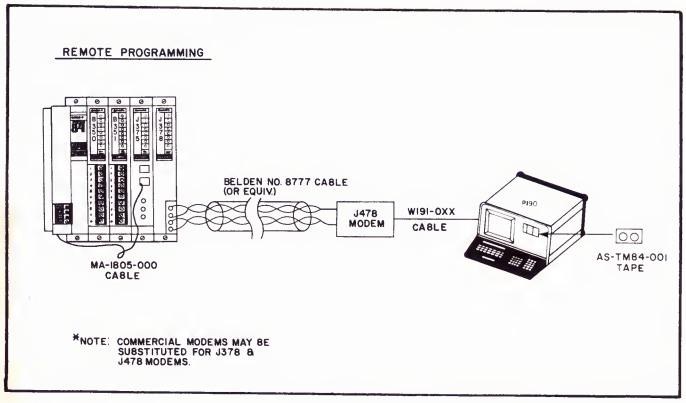
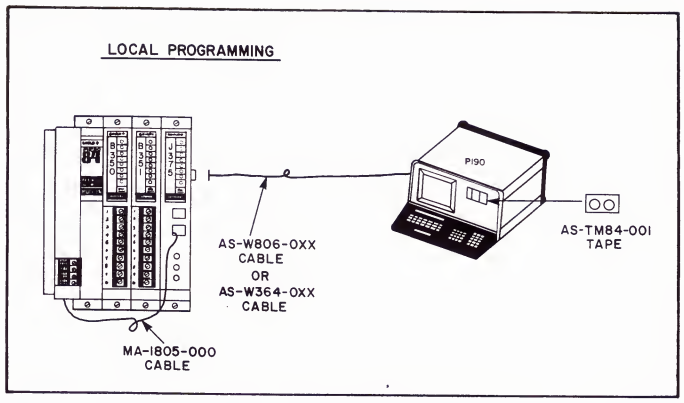




SPECIFICATIONS

Operations
- Start PC
- Stop PC
- Program
- Tape Loader
- Attach
- Detach
- Clear PC
  (logic and/or references)
- PC Configuration

Element and Network Editor
- Read Network
- Edit Network
- Force On/Off
- Enable/Disable
- Hold/Release Reference Display
- Coils Used
- Full Reference Display
- Partial Reference Display
- Search Display
- Search List
- Print (any P190 display)

Network Editor (only)
- Create Network
- Delete Network
- Dummy References or Presets
- Replace Network
- Flip Network
- Exchange Network
- Expand/Compress Network

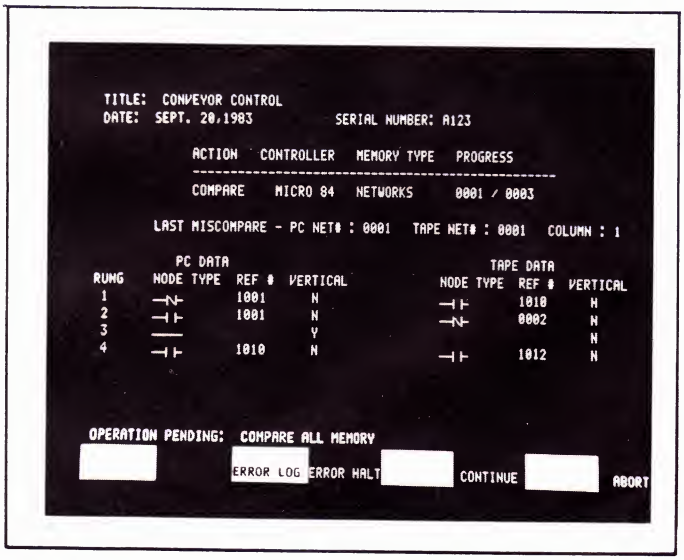
Tape Loader
- Load
- Record
- Compare
- Program Pack

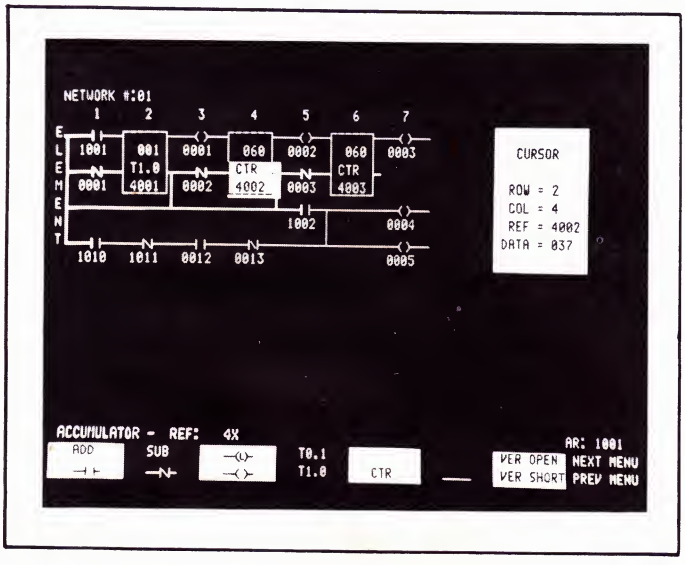
Load PC
- All Memory
- Selected Networks
- Selected Registers

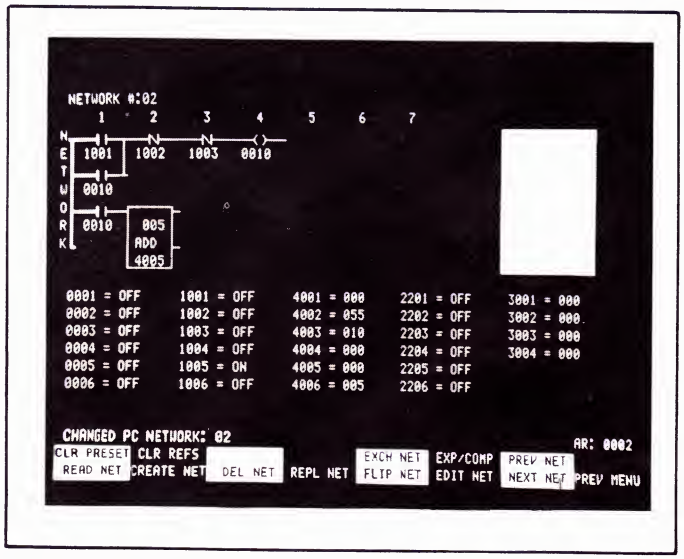
Record PC
- Set Title
- Set Date
- Set Serial Number

Compare PC
- All Memory
- Selected Networks
- Selected Registers
- Error Halt Mode
- Error Log Mode
- Maximum Miscompare Count

Media
- 3 "son" ready-to-use cartridge tapes (non-reproducible) Scotch DC100A or equivalent.







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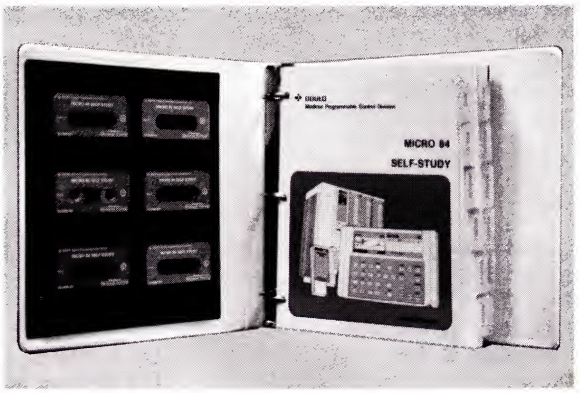
FEATURES

- Low cost
- Convenient scheduling
- Use with or without a CM84A I/O Simulator
- Frequent progress checks
- Written / lab exercises
- Audio/text format
- Educationally tested and proven



COURSE DESCRIPTION

Audience

Designed for the student wishing to learn how to use the Gould Modicon Micro 84 and the fundamentals of automatic control theory including ladder logic diagramming.

Prerequisites

The student taking this course should be able to:

- Apply basic electricity theory
- Use common hand tools for cabling

Duration

Individual learning time is approximately 15 hours.

Objectives

The student successfully completing this course should be able to:

- Plan an automatic control system using the Modicon Micro 84 as system base.
- Install and cable all modules of the Micro 84 system.
- Write, debug, and implement ladder logic programs for the Micro 84.
- Take remedial action if the system fails.

Media

Instructional text supported by audio tapes and reference cards.

TOPICAL OUTLINE

- Self-Study Program Overview
- Automatic Control Methods
- Control System Planning
- Micro 84 PC System
- Micro 84 Application
- Register and Analog I/O
- Progam Elements
- Programming the Micro 84
- Programming Techniques
- Micro 84 Troubleshooting
- Modbus Interfacing

MODEL AND PRICE

SS-M84A-SP1	**$200.00**	**Micro 84 Self Study**
SS-1000-TRH	**$ 75.00**	**Tape Recorder**

ORDERING INFORMATION:

Call (603) 893-0400 X3101 to place order. Orders will be shipped within 10 working days from receipt of check or purchase order. State and local taxes must be included with order.

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PROGRAMMABLE CONTROL DIVISION

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Document Part Number ML-M84A-USE Rev G

Title Micro 84 Programmable Cont. User's Manual

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How do you use this document?

- ☐ Introduction to the product
- ☐ Classroom resource
- ☐ Self-study
- ☐ Programming procedures
- ☐ Advanced programming techniques
- ☐ Operating instructions
- ☐ Reference
- ☐ Other _____

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- ☐ Received from Sales or Customer Service Representative
- ☐ Ordered from Gould PC Division
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- ☐ Other _____

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		Excellent	Very Good	Good	Fair	Poor
Technical Accuracy	- Does the system work the way it is described in the manual?	☐	☐	☐	☐	☐
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Examples	- Are the examples helpful and realistic?	☐	☐	☐	☐	☐
	Are there enough examples?	☐	☐	☐	☐	☐
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Are there any terms or concepts that are not defined clearly? Y ☐ N ☐

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After reading this document, are you able to use the equipment? Y ☐ N ☐

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